SCIENTIFIC AMERICAN

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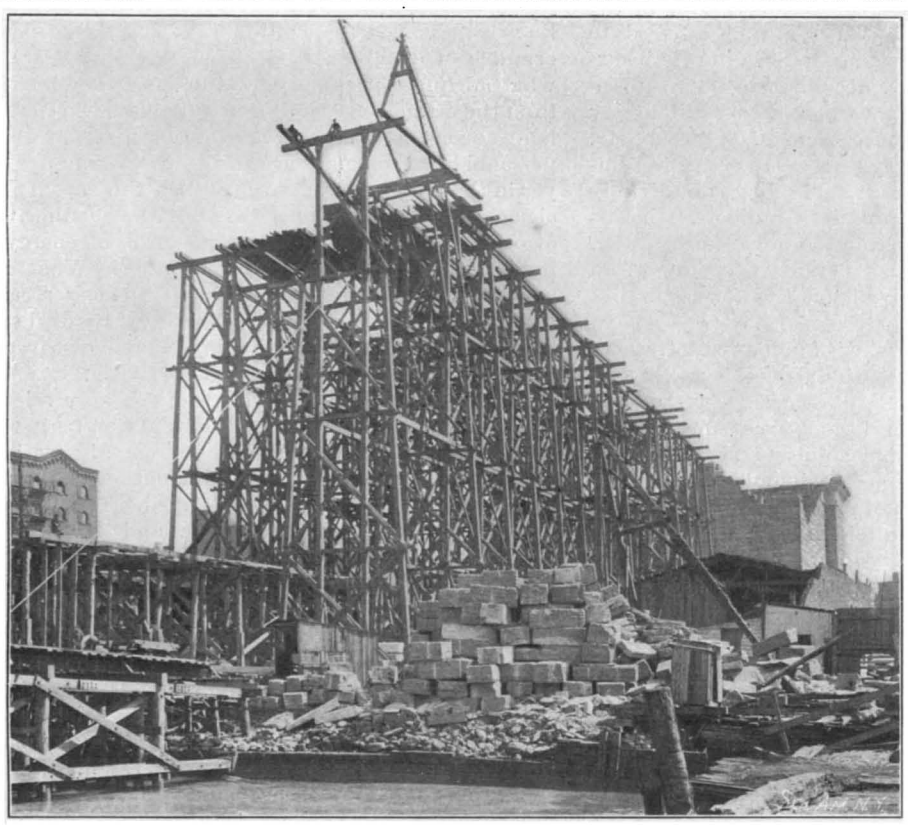
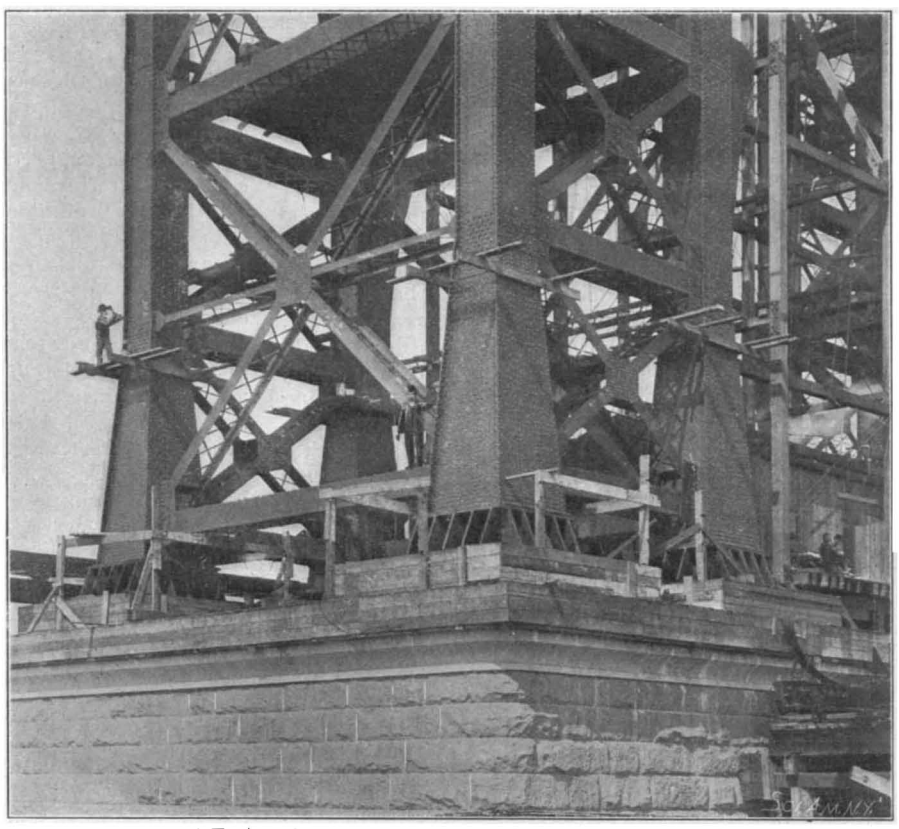
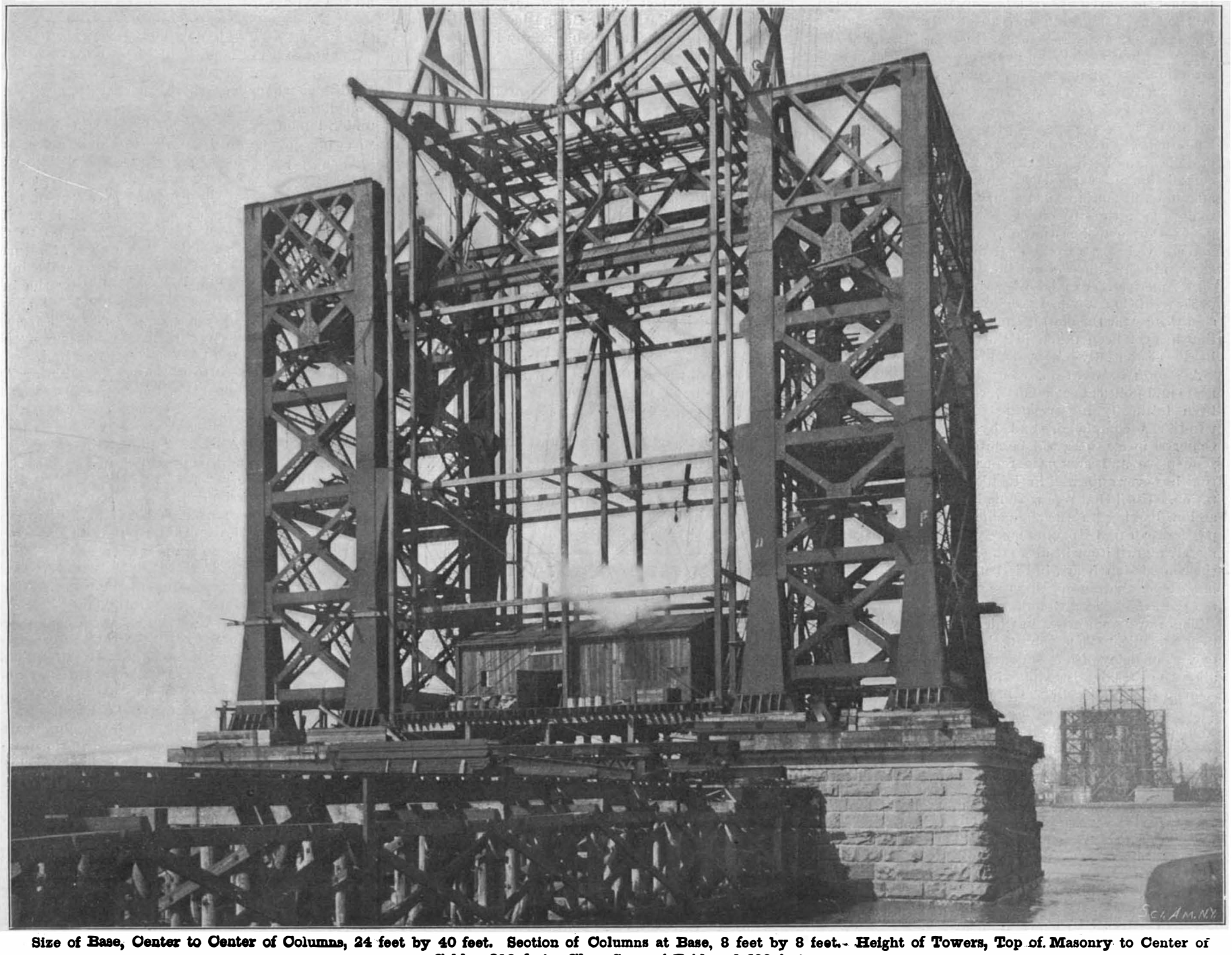


False-work and Anchorage on the Brooklyn Side.

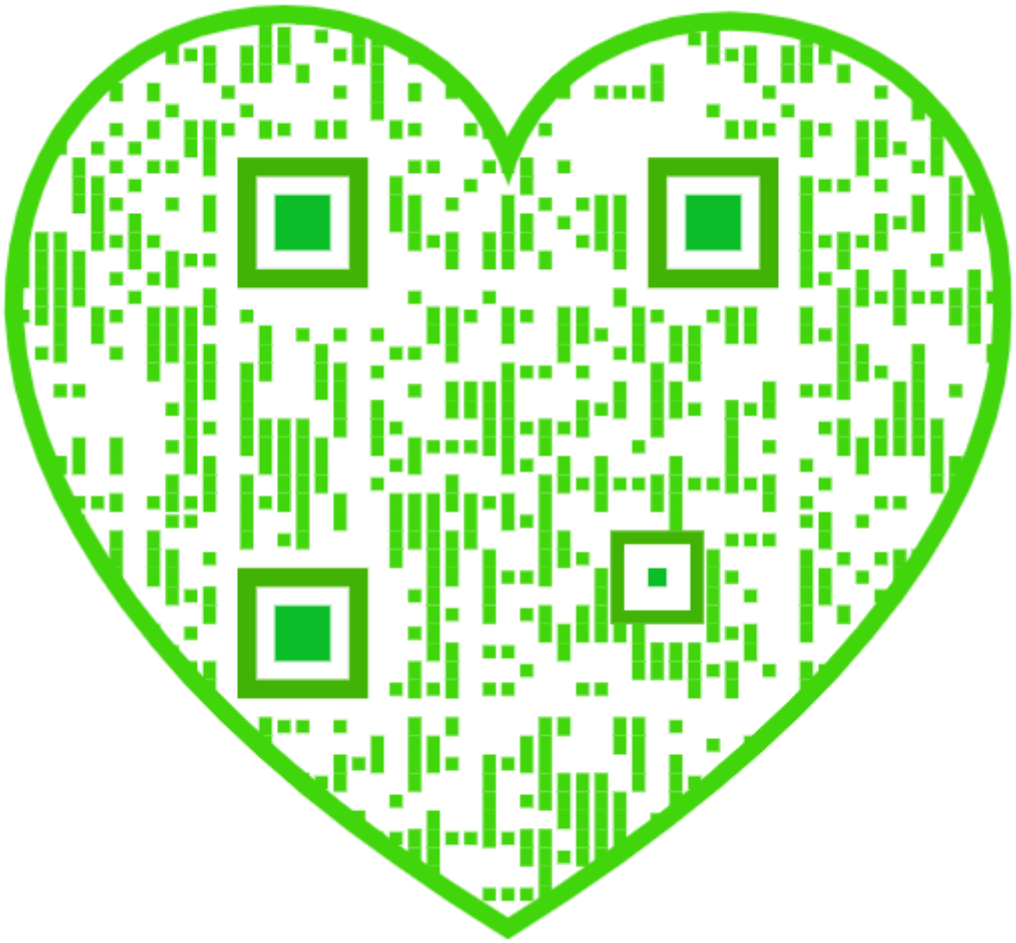


Base of Tower, Showing Enlarged Columns and Pedestals.



Size of Base, Center to Center of Columns, 24 feet by 40 feet. Section of Columns at Base, 8 feet by 8 feet. Height of Towers, Top of Masonry to Center of Cables, 310 feet. Clear Span of Bridge, 1,600 feet.

ERECTION OF TOWERS OF THE NEW EAST RIVER BRIDGE.—[See page 294.]



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NEW YORK, SATURDAY, MAY 12, 1900.

THE PASSAGE OF THE NICARAGUA CANAL BILL BY THE HOUSE.

The question of the construction of a canal across the Isthmus may be considered from many standpoints—international, political, strategic, commercial and technical. Once the construction of a canal has been decided upon in a general way, there are reasons why, the very first point from which the subject should be approached is the last of those named above—the technical, or to be more particular, the engineering point of view. Included in the term Isthmus is a stretch of country several hundred miles in length, whose topography is such that it necessarily presents many different routes which might be chosen for the cutting of the desired canal; and, evidently, unless canal building, for some inscrutable reason, is to be exempted from those common-sense principles which govern men in the ordinary business affairs of life, the very first thing to be done, before turning a spadeful of earth or voting a dollar for construction, is to make a thorough investigation of the ground and determine which route, all things considered, is the best.

Failure to take this obvious preliminary step is primarily responsible for all the ignorance, confusion, folly, and financial disaster which have marked the history of the Isthmian canal project, whether at Panama or Nicaragua, in the old world or in the new; and it is a fact that, even at this late day, there is not a man on the face of the earth who can say with the certainty of absolute knowledge whether this route, that, or some other, is the best that can be selected in respect of construction, cost, maintenance, operation and profit.

After many weary days of profitless discussion Congress, at the close of its last session, seemed suddenly to awake to this very fact, and with commendable promptitude it acted upon the question by voting one million of dollars and authorizing the President to appoint a commission and expend this sum of money, none too adequate, in making such a survey as would enable it to approach the stupendous problem with an intelligent estimate of the situation.

We have heard a great deal during the recent discussion in the House about the desirability of building an "American" canal. We venture to say that the decision of Congress last year to appoint this commission was by far the most distinctively "American" step that has yet been taken in the matter—"American" because essentially practical and common-sense.

A strong commission, composed of eminent engineers and political economists, was appointed, and has been faithfully investigating. Its labors are about two-thirds completed, and by the time the next Congress meets there will be submitted the only comprehensive and adequate report upon the situation that has ever appeared in the history of this canal agitation. Until that report is made public any definite action looking to the immediate construction of a particular canal is not merely presumptuous, not merely a gratuitous insult to the President whose name the commission bears, but it betrays a spirit of fretful impatience that more befits the nursery or kindergarten than the legislative halls of the nation.

There are some crises in which it specially behooves us as a people, to "make haste slowly;" and surely this is one. The delay of a few months which is necessary to allow the President's commission to report is of no consequence whatever in the prosecution of a national work which may require a decade and a half for its completion; particularly if such delay will serve to cool the heated passions, and clear the clouds of ignorance, which were so abundantly manifest during the debate that preceded the passage of the Hepburn Bill.

We earnestly commend the above considerations to the Senate with the hope that it will judge the question with that breadth of outlook which was so conspicuously wanting in the recent debate in the house.

AMERICAN LOCOMOTIVES IN GERMANY.

It seems that early in the present year a letter was sent by the Bavarian State Railway administration to the two leading makers of locomotives in that kingdom, in which it was explained that the principal purpose of the Bavarian government in ordering American locomotives for service on the State railways was to give Bavarian engineers and engine builders an opportunity to ascertain what were the superior features in the American machines, and imitate and incorporate them in their own locomotives. Attention is drawn to the fact that the Bürger Zeitung, of Berlin, states, in a recent issue, that the Prussian State Railway administration also intends to make an early trial of American locomotives, being convinced that these machines have shown, by reason of their great boiler space and heating surface, that they are more efficient and economical. The Minister of Public Works of Berlin, referring to the Bavarian State Railways trials, says that "with faultless performance" they have "cost considerably less than locomotives of similar class belonging to the Prussian railway system." The journal referred to above concludes by saying that it need hardly be explained that if these engines demonstrate their superiority, and are adopted, they will not be built in any foreign country. Our Consul-General at Berlin, Mr. Frank H. Mason, pertinently remarks that this is a sincere and flattering compliment, and though not directly and largely profitable to American builders, it has its value as an illustration of the importance of protecting, as far as possible, by German patents, every American invention or improvement which is sold for use in that country.

Everyone of our readers who is familiar with German methods of developing home industries, is well aware that imitation and adoption of American methods is not confined to American locomotives, but applies broadly to American tools, machinery and a thousand and one articles of American design and manufacture, which, unfortunately, are not patented in that country. If the incident carries its full significance it will stimulate inventors in this country to protect themselves not merely by patents, but also in the broad field of trade marks and designs.

THE CANTILEVER SYSTEM OF BRIDGE CONSTRUCTION.

We are informed that the contract has been let for the construction of a steel bridge which will exceed in the length of its main span, not merely the two great suspension bridges across the East River at New York, but the celebrated cantilevers which stretch across the Firth of Forth at Queensferry. The Brooklyn Bridge measures a few feet under 1,600 feet between the towers; the new East River Bridge between the same points of measurement will be exactly 1,600 feet; the two main spans of the Forth Bridge are 1,710 feet in the clear, while the great bridge now to be erected across the St. Lawrence at Quebec is to have a central span of 1,800 feet. The securing of the contract by the Phœnix Iron and Steel Company, of Phœnixville, Pa., is another distinct tribute to bridge builders of this country; for it is certain that the award of a $4,500,000 contract for the erection of a bridge on British territory would not have come to this country if the British bridge builders had been able to offer superior inducements in the way of design and economy.

It is significant that in spite of the oft-repeated statement that all subsequent bridges of this magnitude would be constructed on the suspension principle, the new Quebec Bridge is to be of the cantilever type. The old objection of lack of stability which formerly held against suspension bridges has disappeared. The principles of the suspension type are better understood, or, shall we say, better applied, than they were, and with the improved materials that are now available, it is possible to give suspension bridges of the largest size all the rigidity which can reasonably be asked for. As regards the question of economy, the cantilever is by far the more costly type, the difference in cost increasing at a multiplying ratio of the increase in length. In view of this fact it is probable that the adoption of the cantilever type at Quebec was due to the local conditions.

SCIENCE FOR THE LOVE OF IT.

Our forefathers were wont to draw the line rather sharply between the professions and the trades. The professional man, it was thought, labored chiefly for the pure love of his calling; the tradesman, for what it brought him. To-day there is a gradual breaking down of the wall that once separated the man with the trained intellect from the man with the trained hand, and the ethical distinction between the professions and the crafts is now so finely drawn that it can be no longer honestly maintained that their representatives are not equally alive to the pecuniary rewards of their daily labors.

Something of that altruistic devotion to his calling which was thought to be the distinguishing mark of the professional man, still lives and thrives in the modern scientist. It was one of the foremost of our American physicists, Joseph Henry, who said:

"My ambition is to add to the sum of human knowledge by the discovery of new truths, which may be of some use to the world. The practical application of these I leave to others."

So completely have the material achievements of science overshadowed what may be called its theoretical development, that we are inclined to underestimate the work which has been done in pure science for the mere love of it.

In our admiration of the skill which has given us our long-span bridges, our towering city buildings, our colossal locomotives and steamships, we are apt to forget the rarer skill and deeper processes of thought which have lately brought to light hitherto unknown elements in the atmosphere, and added something to our knowledge of the solar system.

It is because the work of the pure scientist is so self-sacrificing and unselfish that he commands our special regard. With but little prospect of material advancement, he is content to labor long years for the sheer joy of adding something to the sum total of human knowledge. Not to mention that most conspicuous example of disinterested scientific research, Faraday, what adequate pecuniary reward has Tyndall derived from the arduous research that culminated in his brilliant theory that heat is a mode of motion? What personal advantage has accrued to Crookes and Lockyer in their endeavor to prove that the seventy odd elements known to chemists are but the modifications of one matter, even as our various forms of energy are but the manifestations of a single force? What commensurate reward have Darwin and Spencer received for their investigations in the theories of natural selection and evolution, or Rœntgen for the discovery of the rays that should rightly bear his name?

But although the achievements of the pure scientist are financially unprofitable, they yield rich fruit to be garnered by other hands. Without the discoveries of Henry in electromagnetism, the invention of the telegraph would have been long delayed. The infinitesimal calculus devised by Leibnitz and Newton was not merely a valuable addition to the science of mathematics, but also one of the foundation-stones of modern mechanics. For, a knowledge of the theorems regarding the ultimate values or limits of the ratios of variable quantities is almost as necessary to the civil engineer as the iron with which he builds his bridges. And yet, it is possible that neither Leibnitz nor Newton ever suspected how their system of higher mathematics would aid subsequent investigators in formulating and expressing those laws of mechanics which underlie the superstructure of modern engineering. These are facts, the significance of which we are apt to forget in an age so purely utilitarian as our own.

THE CAPE NOME GOLD FIELDS.

The interest in the new gold fields is so great at the present time that a really authoritative account of the conditions which exist there, such as is furnished by Consul Smith of Victoria, will be welcomed. He wrote under date of December 21, 1899, and stated that there was every indication that there would be a great rush to Cape Nome the present spring. The distance from Victoria to Cape Nome is 2,500 miles and is performed entirely by water. Transportation companies have booked large numbers of passengers, and it has been computed that 65,000 persons desire to go to Cape Nome as soon as possible. A number of returning miners called at the Consulate at Victoria and exhibited specimens of gold saying they were dug on the beach near the water's edge. Men with only hand shovels, and the simplest and rudest of pans, cleared from $50 to $100 and even $300 per day, and sometimes a "clean up" of from $1,000 to $1,500 has been reported.

Nuggets worth $300 to $400 were found near Anvil Creek, and it is believed that between $300,000 to $400,000 was taken out of Snow Gulch last summer. One man, it is said, took $190,000, while another claims still more than that. According to their statements the gold does not extend to a great depth, 5 or 6 feet being as low as any have yet found "paying dirt." By the decision of Commissioner Hermann no land below ordinary high tide can be disposed of to individuals or corporations, but is open to the public to operate on; the right to dig in these lands is as free as the right to fish in the adjacent waters, so anybody may wash gold out of the sand between high and low water. Anxiety is expressed regarding the establishment of a port of entry at Cape Nome. Captains all agree that there is practically no anchorage or harbor at the cape itself, but at Port Clarence, distant only a few miles, there is a safe and commodious harbor. The market quotations for provision are very high, beef selling from 75 cents to $1 per pound; flour, $10 a hundredweight; butter, $1 a pound; coal, $57 a ton, and lumber, $250 per thousand feet. The ruling prices of the restaurants are extremely high, a steak with coffee, bread, cheese and pie would be about $5. An ordinary two-story dwelling of eight rooms rents for $200 a month; for the delivery of heavy freight, by horse team and wagon, $10 per hour is charged; the price of a shave is $1, and it costs the same amount to have a white shirt laundried. Longshoreman have been paid $2 an hour for their labor, and carpenters receive $1.50 an hour. From these figures it will be seen that while it may be comparatively easy to obtain considerable quantities of gold, that the mere cost of staying at Cape Nome is enormous. Probably with an increased number of steamers the prices may be decreased.

STEERING TORPEDOES BY MEANS OF WIRELESS TELEGRAPHY.

BY F. A. A. TALBOT, TUNBRIDGE WELLS, ENGLAND.

The great destructive power of the torpedo is limited by its range and the difficulty of steering it with certainty, except for moderate distances. If a Whitehead torpedo after traveling 800 yards, strikes the target, it is doing exceptionally good work, and under the conditions of an engagement, when the distance and speed of the ship to be attacked are only approximately known, the difficulties of making a successful hit increases in proportion.

The Sims-Edison and the Brennan torpedoes were the outcome of attempts to control the movements of these weapons over areas far greater than can be covered by the Whitehead, the Howell, or other torpedoes of the automobile type. In each case a cable connection was maintained with the operator on shore, and the steering was performed electrically by means of electro-magnets acting directly upon the helm. Obviously the efficiency of these craft is somewhat impaired by the very connecting wires which increase their radius of action; for the drag of the wires, if they are unwound on shore, or their weight, if they are unwound within the torpedo itself, cuts down the speed, placing a limit upon the range.

It was natural that the successful results obtained with Marconi wireless telegraphy should have suggested its use for the steering from a distance of floating and submerged vessels. Residents of New York will remember the proposition of last year, on the part of a well-known electrical expert, to control the fleets of America in distant seas by the single will of an operator snugly ensconced in his Sandy Hook office. Now, although that scheme called for a somewhat vigorous exercise of the imagination, the principles upon which it was to be worked were so far sound, that the steering of vessels by wireless telegraphy has been recently accomplished in a bona fide, if on a somewhat diminutive test, recently carried out in the south of England for the British government.

Mr. Varicas, the inventor of the system, first commenced his experiments in the early part of 1898. No serious trials of the apparatus were attempted, however, until two or three weeks ago, when a private test was carried out before some representatives of the naval department of the British government, and the results were so satisfactory that further trials are to be conducted in the English Channel.

The torpedo boat, with which the experiments were conducted at this private test, was only a model about four feet in length, and in order that the invention should be given a fair trial the experiments were carried out in the public swimming bath at Yeovil, instead of in the sea at Weymouth, near by. At one end of the bath a transmitting apparatus similar to that employed by Marconi in his wireless telegraphy was set up by Mr. Varicas. At the farther end of the pool, which is about 100 yards in length, the small launch was placed in the water. The little vessel is capable of traveling at four knots an hour, the screws being driven by an electric motor, fed by a storage battery. A primitive receiver capable of working the conventional Morse writer at a distance of several hundred yards is ordinarily placed in the launch, but in this particular test this writer was replaced by a rudder-turning contrivance which was normally held hard-a-starboard by a spring. The launch was also equipped with a mast, from which a short wire projected.

Mr. Varicas and Commander Colwell, who was carrying out the test for the government, stood by the transmitting apparatus, while an assistant attended to the launch at the other end of the bath. When all was ready, the assistant started the motor in the launch and the little vessel answering its helm naturally turned to port. Commander Colwell uttered an order, Mr. Varicas turned the controlling wheel of the transmitter, and the little boat immediately altered her course to the desired direction. Then followed further orders from the commander, and the launch quickly performed all the necessary evolutions, as though a quartermaster were aboard and shifted her helm according to the various commands, "Hard-a-port," "starboard," "forward," or "reverse,"—the little craft promptly responded. One of the most difficult experiments was when Commander Colwell threw a short stick into the water and commanded the inventor to bring his craft from the extreme end of the bath and make it collide with the obstacle, a maneuver which was performed with equal ease. The vessel has also been tried on one or two occasions in the open sea at Weymouth, and although the strain has been very severe upon the diminutive craft, since she is scarcely of sufficient size to withstand the buffetings of the waves, yet she has performed the same maneuvers with perfect satisfaction.

A VESSEL of the Orient line will be navigated so as to bring the ship upon the central line of totality off the coast of Portugal at the time of the eclipse on May 28. The journey will be from London or Plymouth to Gibraltar or Marseilles. The passenger can make the complete journey in about fifteen days.

PARIS EXPOSITION NOTES.

The American Forestry Building has been sent from Chicago in sections to Paris. It is probably the first time that an American building for exhibition purposes has been shipped across the Atlantic.

A foot bridge in the Champ de Mars which connected the Exposition with the Globe Celeste collapsed on April 29, killing several and injuring many. The Globe is an outside attraction and was not in the grounds, therefore, the managers of the Exposition were not to blame. The bridge had been condemned in the morning and no one was allowed to walk over it.

The Exposition is now finally assuming shape and order is being brought out of chaos. The galleries are gradually filling with exhibits and they are being installed as rapidly as possible. So far there have been two fires in the exhibition grounds which have shown how great is the danger of a conflagration, the facilities for fighting fire being very meager. Special measures are now being taken to remedy the situation. When the fountains are playing, it will undoubtedly be a difficult matter to secure water, for during the burning of the Comédie Française, notwithstanding the great lack of water, the fountains were not turned off.

The different parts of the Exposition will be connected by a small electric railway, which follows for the most part the same route as the elevated moving platform, passing along the side of the Champ de Mars, the Quai d'Orsay, the Esplanade des Invalides and the Avenue de la Motte Picquet. Along certain parts of the route it has been placed under the structure of the moving platform, and in other cases it follows it at one side upon a lower level. Along the Avenue de la Motte Picquet, it is supported upon an elevated structure by a series of iron arches placed over the sidewalk, the moving platform occupying a similar position on the other side of the street. At the entrance to the Invalides Bridge it crosses over a viaduct and passes underground by the Pont de l'Alma. It contains in its course several grades of 4 per cent, and curves of small radius. The track is of one meter gage and the total length of the route is about 3½ kilometers. A number of elevated stations have been established, to which access is given by staircases or by inclined elevators consisting of a continuous, flexible web passing over a series of drums. The train is made up of one motor car and two trailers, having a total capacity of 210 places. The motor cars have a two-wheeled truck at each end, carrying Westinghouse motors of 25 horse power. The current is taken from a railroad rail laid along the ties outside of the main track; it rests upon insulating blocks placed at intervals. At the time of heaviest traffic the trains follow each other at intervals of 90 seconds, making about 40 trains per hour, or 8,400 passengers.

The United States building has a prominent place among the buildings of the other nations represented at the Exposition. These have been constructed upon a long platform extending along the Seine from the Invalides Bridge. It is at a considerable height above the water-level, and is upheld by a sub-structure of iron work. The series of national buildings presents an imposing effect, each being built in a characteristic architectural style, some of white staff, others richly decorated, imitating stone and other materials; others, such as the Swedish Pavilion, are entirely of wood. The Italian building is very large, and is in the style of the fifteenth century; its construction resembles that of a cathedral, and it is richly decorated with exterior frescoes and surmounted by three gilded domes. The Turkish building is almost entirely of white staff, with characteristic pointed arches; it is relieved by an exterior border in which blue predominates. The United States building comes next to that of Turkey, and is followed by that of Austria. The buildings are separated by a considerable space, and at the front of the platform passes a pavement running along the entire length of the series. The United States building has a main body of octagonal form with four long and four short sides, and is surmounted by a high dome. In front is a portico which spans the pavement by an arch on each side, and a third arch overlooks the river. Under the latter is an equestrian statue of George Washington of colossal size in white staff, mounted upon a square base about ten feet high. The hemispherical ceiling of the portico has a fresco by Robert Reid of pleasing effect; it represents the Goddess of Liberty seated upon the clouds and holding a shield, with the American eagle to the left in the rear. The main door of the building is at the back of a niche, and is reached by a flight of half a dozen steps. Over the door is a fresco representing the genius of the nation and the various arts and products; it has a fine effect when seen from the pavement. Surmounting the portico is a large group in white staff representing the Goddess of Liberty drawn in a quadriga. The main dome is of white staff, like the rest of the building, but is ornamented with gilded palm branches at the four corners, with a smaller leaf ornamentation between. At the top is a globe carrying a gilded eagle with outspread wings, and at the base of the dome, on four sides, is a shield surmounted by an eagle in white staff. A handsome frieze surrounds the building, representing arms and trophies in relief. On each side of the portico, next the river, is a high flagstaff with an ornamental base, carrying a large flag. The interior rotunda is surrounded by the balconies of the different floors. At each side of the entrance door is an electric elevator, and in the corners of the building are staircases leading to the upper stories. On one side is a model American post-office, and arrangements have been made by which letters mailed here will be shipped direct to New York. The different floors will be mainly occupied by the offices of the Commission; on the lower floor will be the reception rooms and on the second floor a lunch room. Against each of the columns of the lower floor is a handsome bronze fixture containing five incandescent lamps. The United States building has been favorably commented upon, and it is the only one of this series which is ornamented with sculpture groups of any importance. As seen from the other side of the river it presents a very handsome appearance, and adds greatly to the effect of the series.

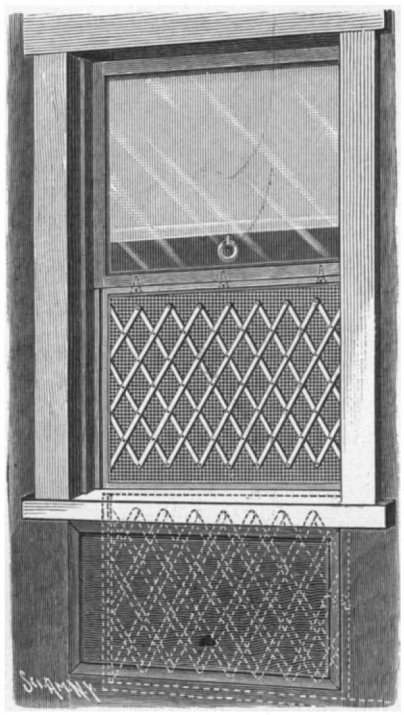
AUTOMOBILE NEWS.

The Italian government has purchased some steam motor vehicles of large size capable of carrying four tons and hauling another vehicle carrying eight tons.

On account of the Paris Exposition, the automobile races in France this year will be especially numerous and interesting. Up to the middle of April four important events have taken place, the Course du Catalogue, the Coupe des Voiturettes, and the races at Pau and at Nice. The two former events were carried out upon a new system of classifying the vehicles, these being grouped according to the catalogue price of the truck and motor, not taking into account the carriage-body. This system has proved satisfactory and affords a precise method of classification, which is otherwise somewhat difficult. Class A, with a price below 3,000 francs, includes light vehicles whose weight is below 250 kilogrammes; class B, 3,000 to 6,000 francs, includes a somewhat heavier type. In class C are included the touring vehicles, with prices from 6,000 to 9,000 francs, having motors of 6 to 8 horse power. The other classes, whose vehicles cost from 9,000 to 15,000 francs and over, include heavy vehicles whose motors range from 8 to 16 horse power, such as the Panhard & Levassor, Bolide, George Richards and other makes. The results given by the latter vehicles were better than those of the other classes, without, however, being greatly in excess. The best result was that obtained by Girardot, with an average speed of 50 kilometers per hour. The vehicles of class B, made a good showing, and M. de la Roëre, with a Hurtu machine, covered the route with a mean speed of 32 kilometers. The races held at Pau, which included different events, were a decided success for the Panhard & Levassor automobiles, which were obliged to compete with several prominent makes such as Mors, Bollée, etc. M. René de Knyff, mounted upon a 16-horse power machine of the Panhard type, covered the distance at the high speed of 70 kilometers per hour, which he held for five hours. The races known as the Coupe des Voiturettes, organized by the Journal des Sports, were reserved for light automobiles weighing below 500 kilogrammes, these being divided into two groups, the lighter, below 250 kilogrammes, and the heavier from 250 to 500. These groups were subdivided according to the type of refrigerating apparatus used, namely, air or water cooling devices. The races took place on March 11, over the route from St. Germain to Rouen, returning by a different road, and covering 218 kilometers. Of the lighter vehicles, with water refrigeration, there were four entries, only one of which was classed, the distance being made by Camus with a vehicle of the Esculape pattern, in 7 hours 37 minutes, with a mean rate of 28 kilometers per hour. The lighter vehicles, with water refrigeration, had 10 entries, of which 8 were classed; these included the De Dion, Phébus, George Richard and other types. The best time was made by Tart with a De Dion vehicle, an average speed of 38 kilometers per hour. The best speed with the heavier vehicles, with water refrigeration, was made by Théry upon a Decauville machine, being 45 kilometers per hour; there were 14 entries in all, of which 12 were classed, nearly all making speeds from 40 to 30 kilometers. For those with air refrigeration there were 6 entries, but only one classed, the route being covered by Lefèvre, with a Bollée machine, in 8 hours 9 minutes, or 26·7 kilometers per hour. These results indicate that the lighter vehicles with water refrigeration have given the best showing, both in the proportion of the competitors classed and as to speed; seven of the ten first arrivals being of this type. The races at Nice took place in exceptionally bad weather and the results are not very instructive, as the greater part of the vehicles could not run, and most of those who ventured met with a series of accidents. An extraordinary speed was made in a short race by Beconnais, mounted upon a gasoline tricycle: he reached the speed of 90 kilometers per hour, making the kilometer in 39½ seconds, the race lasting for 1 minute 18 seconds.

NOVEL WINDOW-GUARD AND FLY-SCREEN.

The subject of the illustration presented herewith is a guard which can be applied to any vertically-sliding window, which is attached to and moves with the lower sash, and which is so constructed that it can be readily opened whenever it may be desired. The primary purpose of the guard is to provide means for preventing children from falling out of the window. The device



COMBINED WINDOW-GUARD AND FLY-SCREEN.

is the invention of Harry Levy, 1289 Second Avenue, Manhattan, New York city.

In the construction of the window-guard lazy-tongs are employed, carried by a frame which is screwed to the lower sash. The sill of the window is provided with a slot communicating with an opening into which the lazy-tongs and their frame can pass when the window is closed.

It is evident that when the lower sash is raised the lazy-tongs guard is likewise raised to cover the open space, and that, when the sash is lowered, the guard is likewise lowered, as the dotted lines of our engraving show. When the guard is in its uppermost position, the lower bar completely fills the slot, so as to prevent the accumulation of dust.

Most window-guards are defective, in so far as no means are provided for removing the guard in case of fire. The objection has been very simply overcome in the device under consideration. The lazy-tongs are pivoted to one side-bar of their frame, and are adapted to be secured to the other side-bar by means of a hook and keeper. By releasing the hook, the lazy-tongs can be folded together so as to leave an unobstructed passage. The construction, therefore, does not interfere with the closing of the shutters.

In connection with the guard, a fly-screen is employed, which is attached to the upper and lower bars of the lazy-tongs frame. The fly-screen is constructed so that it can be readily raised and lowered independently of the sash, and is provided with a catch engaging the upper bar of the guard-frame, by means of which catch it is held in raised position. The fly-screen and guard can be used either separately or together. The device is also applicable to the windows of high-speed railway trains.

The Work of the United States Forester.

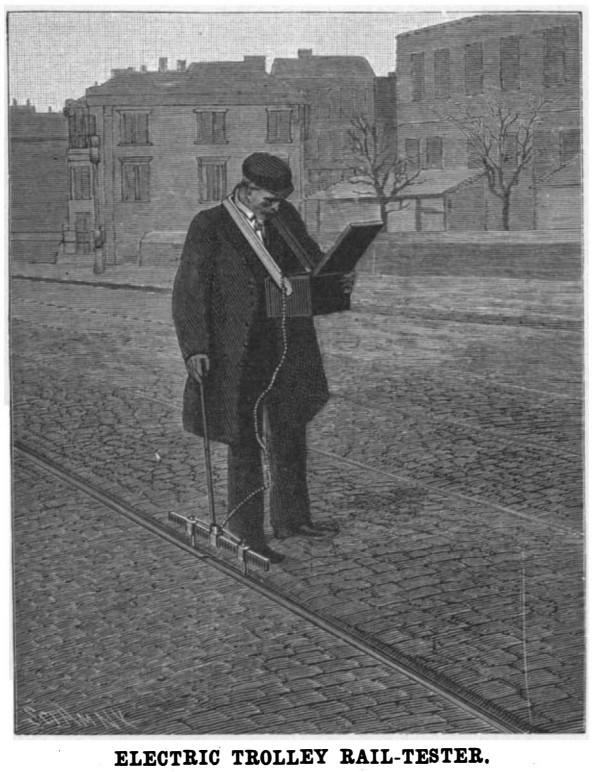
The Division of Forestry of the Department of Agriculture accomplishes each year most valuable work. During the last fiscal year practical and paying forestry has been successfully introduced on two tracts of land of a total area of 108,000 acres, and it has now entered its second year under greatly improved circumstances, while the preparation of working plans for conservative lumbering has been in progress with a view to more than twice that acreage. Important modifications and practical methods of lumbering have been suggested by the division, and introduced by private owners on a large scale with marked success, although more than 400,000 acres have come under the care of the agents of the division with a view to the practical introduction of improved methods. The total requests for such work to date have exceeded 1,600,000 acres. Forest fires have been studied historically, and practically at some length, in eight states in the field, and results of importance have been reached. A plan for systematic contributions to the knowledge of North American forests has been devised and has already yielded very valuable results. A system for a photographic forest description of the United States has been worked out and the collection is well under way. The division is in close and fruitful co-operation with the forest work of the United States Geological Survey. The technical assistants under the supervision of the heads of sections are of various grades. The first grade is that of "collaborators." This grade is filled by experts of established reputation in forestry, lumbering or tree-planting. They are scattered throughout the country, and their function is to prepare and forward for publication treatises on subjects previously agreed upon. There are now eight of these gentlemen, and the Forester is certainly correct in saying that they will be able to prepare authoritative statements of great value at very moderate cost, for the pay of a collaborator is only $300 per annum. The grade of "student assistant" is an important one, and only those are selected who desire to adopt forestry as their profession, and the demand for places very largely exceeds the number of positions which can be offered. The practical experience which they gain is in no sense intended to replace thorough training at forestry schools. There are twenty-eight of these assistants and they receive $25 per month as pay.

Photographing Upon Marble.

The following process for making photographic impressions upon marble has recently appeared and is said to give very fine results. The surface of the marble is well smoothed but not polished. Upon this is spread a layer of the following mixture: Benzine, 500 grammes; turpentine, 500 grammes; bitumen, 50 grammes; beeswax, 5 grammes. This layer is allowed to dry, and the gelatine surface of the photographic plate is then applied and an exposure of 20 minutes made by sunlight. After removing the plate, wash with gasoline, which takes off that part of the varnish which has not been acted upon by the light, and the image gradually appears. The action of the gasoline is stopped at the desired point by washing in a stream of water. The surface thus prepared is plunged into an alcoholic solution of Prussian blue, eosine red, etc. When the color has penetrated by capillary action, the layer of varnish is taken off and the surface of the marble finely polished. In this way a permanent image of a fine color and great depth is obtained.

LORD KELVIN'S ELECTRIC TROLLEY RAIL TESTER.

The services of Lord Kelvin to electrical science have been as great in the industrial world as they have in the classroom, and an exhibit of the various apparatus which has been designed by him would be positively voluminous. We present an illustration of the Kelvin rail-tester which is used to determine whether there are any defects in the conductivity of the rails of an overhead trolley system. The track rails perform the important part of carrying the return current, and it is necessary, not merely to give these rails and their joints a high conductivity at the time of the construction of the track, but also to test them, from time to time for defects. In our illustration the tester is shown as being applied at a joint in the rails in the endeavor to detect a faulty bond. The instrument consists of a graduated bar, upon which are two sliding steel contacts, which are provided with terminals and are connected by means of a flexible wire to the terminals of



ELECTRIC TROLLEY RAIL-TESTER.

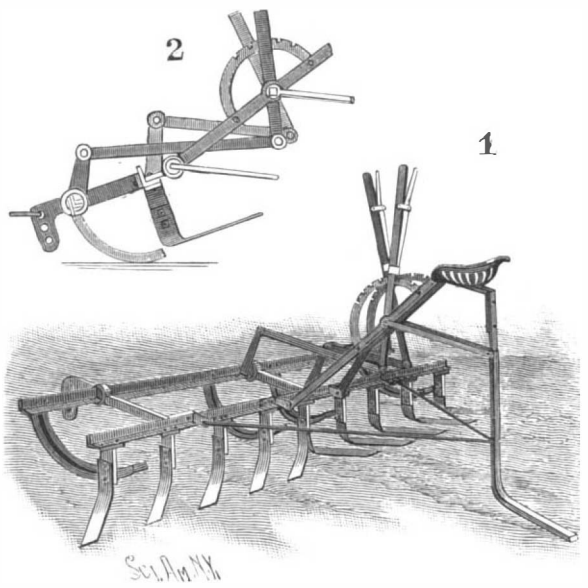
a low-range voltmeter carried in a case which, for convenience, is strapped around the shoulders of the operator. When the lid of the case is opened it forms a desk on which are two paper clips that serve to hold the test sheet. The contact bar is provided with a suitable handle by which the apparatus is placed across the bond in the manner shown in the illustration. The resistance of the rail is indicated directly by the instrument in the case. Various degrees of sensibility may be obtained by altering the positions of the contacts on the bar. For our illustration we are indebted to The Electrician.

A NEW FORM OF WEEDING-MACHINE.

A simple and light weeding machine has been devised by Frank S. Gunning, of The Dalles, Ore., which is so constructed that the depth to which the weeding-knives enter the ground can be readily determined and controlled, even while the machine is in operation.

The frame of the machine consists of a front adjustable portion and a rear, main portion.

The front adjustable portion consists of a forward



GUNNINGS'S WEEDING-MACHINE.

bar adjustably supported by a rear bar. Weeding-knives are carried by the rear bar. Curved runners are attached to the forward bar. These runners determine the depth to which the weeding-knives shall enter the ground, and likewise serve as forward bearings for the machine when it is to be taken to or from the field.

The main frame comprises side bars pivoted to the rear bar of the forward frame and connected with a central drag-bar by means of braces. The side bars have quadrants secured between them, which coact with the thumb-latches of two levers. Of these levers one controls the front bar of the forward frame, so that the bar in question can be turned in its sockets as occasion may require, and the other is connected with the rear bar of the forward frame, so that the entire forward frame can be raised or lowered.

Through the medium of the first lever the runners can be carried up or down the required distance, and through the medium of the second lever the entire front section of the frame can be raised or lowered so as to elevate or depress the weeding-blades.

Early Methods of Food Preservation.

Dr. S. Rideal recently published a paper before the Society of Arts, in which he gave some very interesting information regarding the methods used to preserve food in ancient and modern times. He stated there were only a few early allusions to the use of salt, vinegar and allied substances to keep food from putrefying, and none of them were of much importance.

It was not until the middle of the nineteenth century that is was discovered that small quantities of certain antiseptics would enable the original qualities to be retained and prevent the decay for a considerable period with less influence upon the digestive organs, than the old curing processes.

Recently compressed oxygen and sterilized air have been tried for preserving milk and butter. When the latter is kept in carbon dioxide at a pressure of 6 atmospheres it often remains unchanged for four or five weeks. It has been found, however, ineffective to prevent changes in milk or meat. It has been found also that the sterilizing effect of carbonic acid in mineral waters is not as great as has been thought. Dr. Otto Hahner has examined many mineral waters and found them swarming with bacteria.

The Krupp Iron Works.

The total number of people employed by Krupp is at present 41,750, of which 25,133 are at Essen, 3,458 are in the Gruson Steel Works at Magdeburg-Buckau, and at 2,726 at the German shipyards at Kiel and 10,344 in various smelting establishments and coal mines owned by Krupp. The foundation of these gigantic works was laid in 1810 by the grandfather of the head of the present firm. Essen was then a small town of 4,000 inhabitants; it now has 105,528, inhabitants. The firm owns a large number of iron mines, including the great Bilbao mine in Spain. The ore from the latter is taken to the seacoast by a railroad owned by the firm, and from there it is conveyed to Rotterdam by four of their own steamers. The testing ground for guns is at Meppen and it has a target range of 72.000 feet. In 1892 the great Gruson steel works at Buckau were purchased and three years ago shipbuilding yards were started at Kiel. When they are completed 7,000 men will be employed at this place.

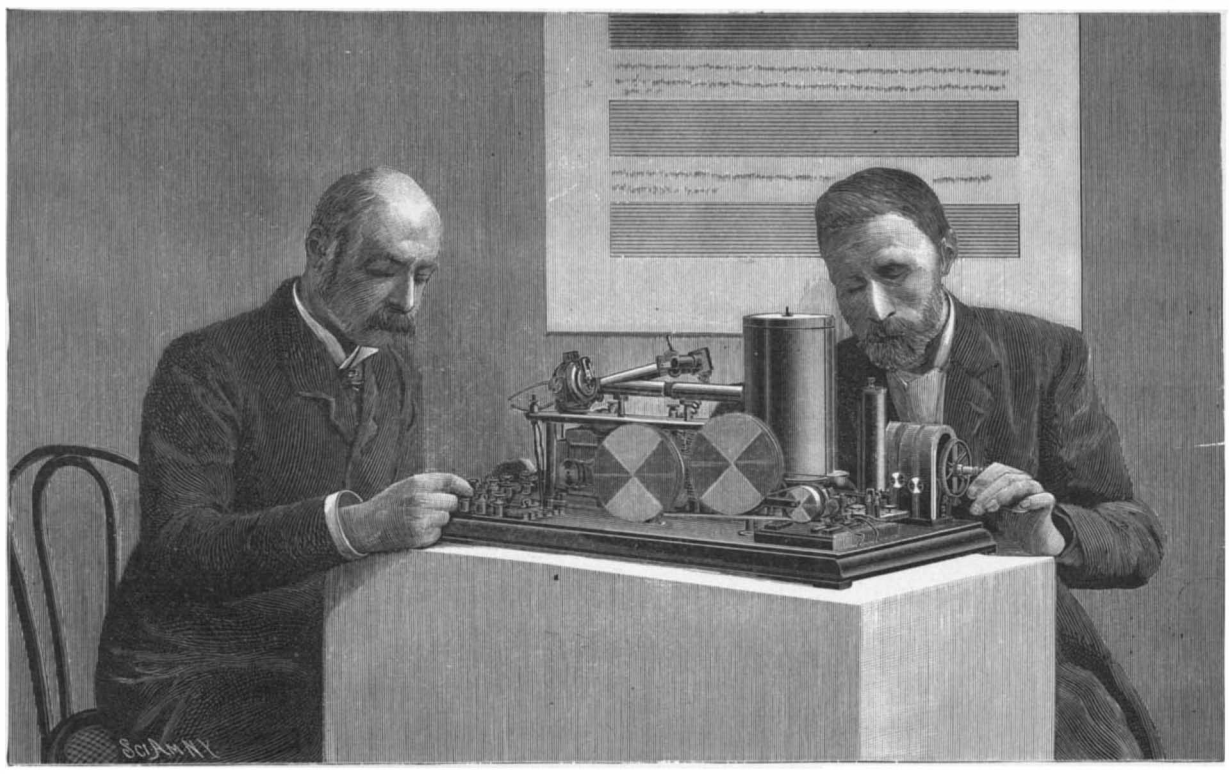
THE POLLAK AND VIRAG TELEGRAPH.

The recent invention by Pollak and Virág of a system of rapid telegraphy is destined, perhaps, to exert a vast influence upon our present methods of transmitting messages electrically.

Herr Pollak was formerly a telegraph agent in a small Hungarian city, and it was only during his leisure hours that he found time to study electric technology. In Virág, who was at the time an examiner in the Hungarian Patent Office, he found an earnest collaborator. Both men have devised various improvements on the electric telegraph; but of all their inventions none is more interesting than their system of rapid telegraphy.

In the system in question, a perforated tape is used, which passes around a wheel electrically connected with the telegraph line. The perforations of the tape are disposed in two lines, of which one lies above, the other below an unperforated central line. The upper line corresponds with the dashes, the lower with the dots of the Morse alphabet. Over the perforated strip are secured two metal brushes, one of which is connected with the positive, the other with the negative pole of a galvanic battery. These brushes, when depressed, will pass through the perforations, and, coming into contact with the wheel, will close the circuit and cause a positive or negative current to flow through the wheel to the receiving station, thereby swinging a mirror to the right or to the left as the positive or negative current energizes the electromagnet with which the mirror is connected. The light of a small incandescent lamp which falls upon this mirror is reflected to the right or to the left, according to the direction of the mirror's oscillation, and is concentrated to a point by a convex lens. This point of light falls upon a piece of sensitive paper, producing a series of lines which are located either above or below a central line, and depending upon which of the two brushes of the transmitter is forced into the perforated tape. The paper after having been developed, reveals characters above and below the central maginary line, which characters correspond with those of the Morse alphabet.

The telegraph is said to be faultless in operation. Between 10 and 12 o'clock P. M. recently, telegraphic communication was opened between Berlin and Ofen-Pest. The Berlin instrument was operated by Herr Pollak; the Pest apparatus by Herr Virág. Representatives of the Hungarian, French, and American governments were present during the trial at the Pest station. A message of 220 words was transmitted in nine seconds, which corresponds with a speed of 88,000 words per hour. The development of the sensitive paper was accomplished in 4–5 minutes. The signs were sharp and clear.



THE POLLAK AND VIRAG RAPID ELECTRIC AND PHOTOGRAPHIC TELEGRAPH SYSTEM.

Floating Stones.

Prof. Erland Nordenskiold, who is the son of the Arctic explorer, recently observed while engaged in scientific research in South Patagonia a most curious sight while rowing in the long and narrow channel of Ultima Esperanza on the southwest coast of Patagonia. He observed fragments of slate floating on the surface in large and small clusters. There were a great many of them, and at one cast of the net he gathered in 700 pieces. The stones had evidently drifted out from the beach, which was covered with similar fragments which had fallen from the slate cliffs. The surface of the stones was dry, and when it became wet the stones sank immediately. Their specific gravity was 2·71, while that of the water was 1·0049. It was found that small gaseous bubbles were attached to the under-surface of the floating stones, and these bubbles were also found on stones at the fringe of the beach, where they were being continuously washed into the sea when floating away. The greasy surface of the slate fragments undoubtedly helped to keep them afloat by preventing the water from coming in very close contact with them. Prof. Nordenskiold believes, besides the visible bubbles, they were surrounded by an envelope of gas supported by an insignificant coating of algæ, by which they were enveloped. The new strata they are now forming at the bottom of the sea may have a considerable admixture of these fragments representing a far distant geological age.

THE "OROGRAPH;" AN AUTOMATIC PROFILE RECORDER.

BY W. F. COFFEE, LONG ISLAND CITY,

The curious machine herewith illustrated was made for the engineering corps of the United States army, and is owned by a detachment of this corps stationed at Willett's Point, Long Island. It is essentially a surveyor's instrument, and is intended to take the place of the engineer's chain and level in the important work of making a profile of any road or stretch of country over which a surveying or reconnoitering party is passing.

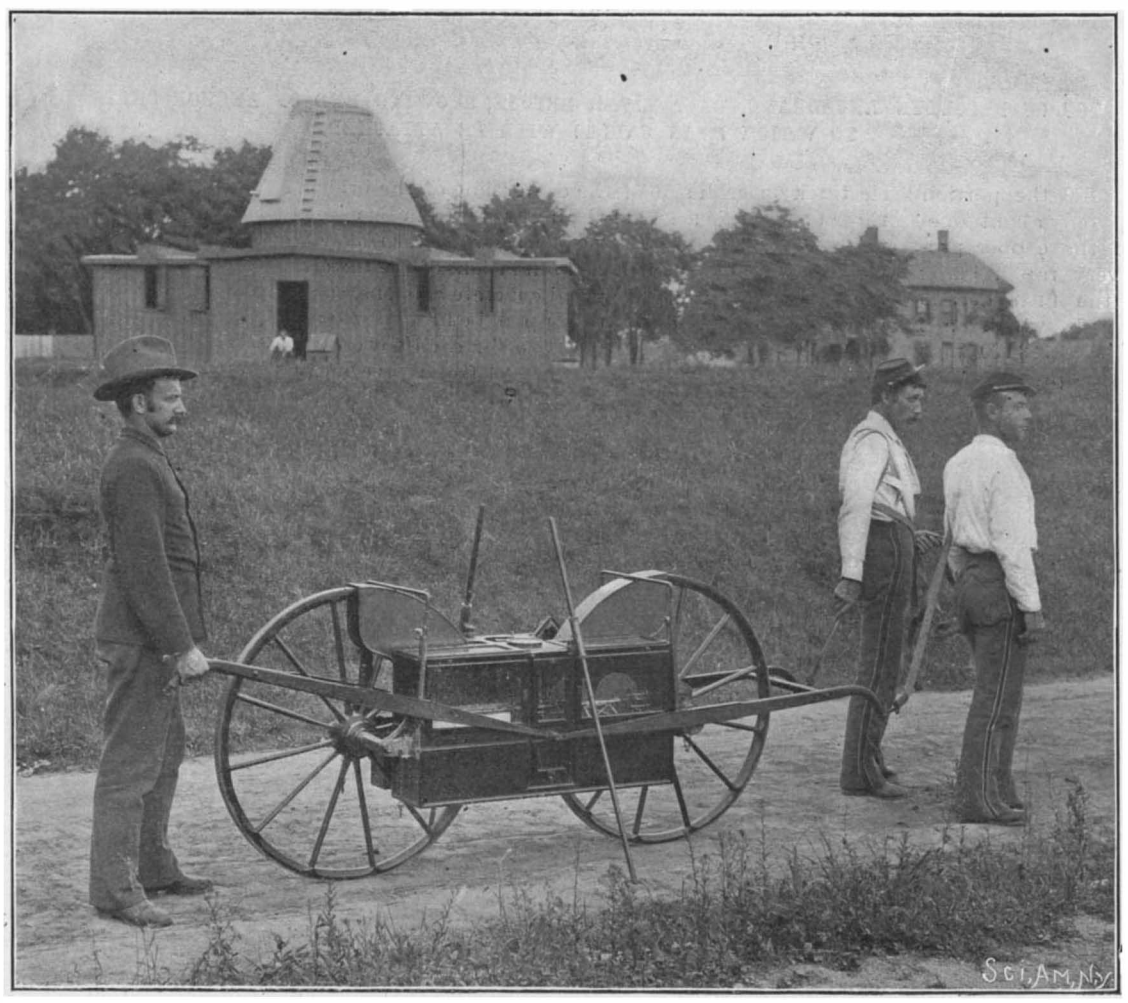
It will be known to most of our readers that the ordinary method of making a profile is to run a level through the country over a line that is laid out by means of the transit and engineer's chain, and take the levels at more or less frequent intervals along this line. These levels are then pricked off on cross-section paper, and a line joining them will represent the true vertical topography of the country along that particular route. Here we see two distinct operations, one in the field, the other in the office. They are both, of course, somewhat tedious and call for exercise of considerable care to prevent errors from creeping in.

The "Orograph" consists of two substantial carriage wheels, one following the other in a single track, supporting between them, and on one side, a box of mechanism, and on the other a sort of cistern. This cistern is 24 inches in diameter and ½ an inch deep. It is placed vertically and contains mercury. When in operation the "Orograph" must be held upright and not allowed to careen to either side.

As stated, the object of the machine is to draw upon paper an accurate profile of the ground over which it is rolled, thus furnishing the army engineers with all the results of a survey excepting the courses and general topography. The principles upon which the machine is constructed are those of the perambulator, operating in conjunction with a lever maintained continually in a horizontal position by floating upon a cistern of mercury. This lever is 24 inches in length and ½ an inch thick, with floats attached to each end, and has free motion in a vertical plane on a horizontal axis.

The principles upon which the reduction of surface distance to true measurement is accomplished are that, if the surface measure of any portion of gronnd be called radius, the true horizontal distance will be the cosine of the angle of inclination or grade of the surface, and the difference of level will be the sine of the same angle. In accordance with these principles an arm or crank is made to move in a slot, or elongated hole, in such a manner as to give it a motion corresponding to such sine or cosine. The machinery by which these principles are made to operate consists of a circular disk, revolving by connection with the perambulator with a velocity proportionate to the surface passed over, and of an adhesion wheel whose plane is perpendicular to the plane of the disk, and whose circumference is tightly pressed against, and so receives motion from it, the distance of its circumference from the axis of the disk being made to vary as the cosine of the inclination or grade of the surface passed over by the Orograph varies. This varying motion of one wheel against the face of another is effected by an arm from the axis of the horizontal lever, moving in a slot, which, together with a parallel motion, sustains the adhesion wheel against the circular disk from which it derives its motion. The adhesion wheel, moving according to the true horizontal distance, communicates motion by means of an endless screw and by ratchet-work to wheels which register all distances up to a hundred miles.

Another arm from the axis of the horizontal lever, moving in a slot perpendicular to the former one, varies the position of two adhesion wheels pressed against two circular disks in a manner similar to the former, but varying in proportion to the sine of the angle of inclination. The two adhesion wheels just mention



THE "OROGRAPH"—AUTOMATIC PROFILE RECORDER CONSTRUCTED FOR THE UNITED STATES ARMY.

ed both revolve in the same direction and with the same axes, and contain within these axes, one a male and the other a female screw. These screws are so arranged that if the adhesion wheels both revolve with the same velocity, by being kept at the same distance from the axes of the circular disks by means of a lever acting through the medium of the slot, the screws, although loose in the wheels, will neither advance nor recede, but a difference of level moving both the lever and the slot, and bringing one adhesion wheel nearer and the other further from the axis of the disks, and, therefore, causing difference in velocities, will make the screw which carries the pencil of altitude advance or recede as long as difference of level causes difference of velocities in the adhesion wheels and the screws which move them.

The arrangement by which the paper is made to pass under the two pencils (one to mark the surface and the other the base line and station) is at once suitable and ingenious. The two rollers upon which the paper is wound is kept tightly straightened by a tendency to motion in opposite directions, communicated to them through friction and from the main shaft, while drum rollers geared to the true horizontal motion deliver the paper under the pencils with the smallest expenditure of force.

The pencil of altitude moves an inch for every 50 feet change of level, and the paper is drawn under the pencils at the rate of an inch for every 500 feet in distance.

The true horizontal distance can be read to tenths of a foot, and the surface distance to every 10 feet. The machinery by which so many complicated movements are produced is substantial and well adapted for service, capable of adjustment in every part, and not liable to get out of order if well used. The cistern containing the mercury is entirely of metal and the frame work is securely trussed and bolted.

The perambulator wheels are made of the best material with steel tires, while the handles by which the "Orograph" is propelled and managed are hinged to the frame work near the center of gravity, adding much to the stability of the machine. The machine, which was very costly to construct, has been frequently loaned as an exhibit at scientific exhibitions. It was last on public view at the World's Fair in Chicago.

Our Copper Industry.

The rapid growth of the copper industry in the United States, and the large proportion which this country supplies of the world's copper, is shown by a German publication entitled "A Century of Copper." It shows that the United States has during the years 1891–1900 produced more than one-half of the copper of the world, while in the preceding decade it supplied about one-third of the world's production, and in the decade, 1871-1880, the portion supplied by the United States was only about one-sixth of the total. The growth of the copper production in the century has been very rapid, being in the first decade 91,000 tons, in the fifth decade 291,000 tons, and in the tenth decade, which ends with 1900, 3,643,000 tons, of which 1,963,000 tons is supplied by North America, a large proportion of this being from the United States. The greatly increased demand for this material is illustrated by the fact that, although the production has increased from 505,909 tons in the decade, 1885 to 1860, to 3,643,000 tons in the decade, 1891 to 1900, the average price has fallen only a little more than half, so that while the production has increased more than six-fold, it costs about one-half what it did.

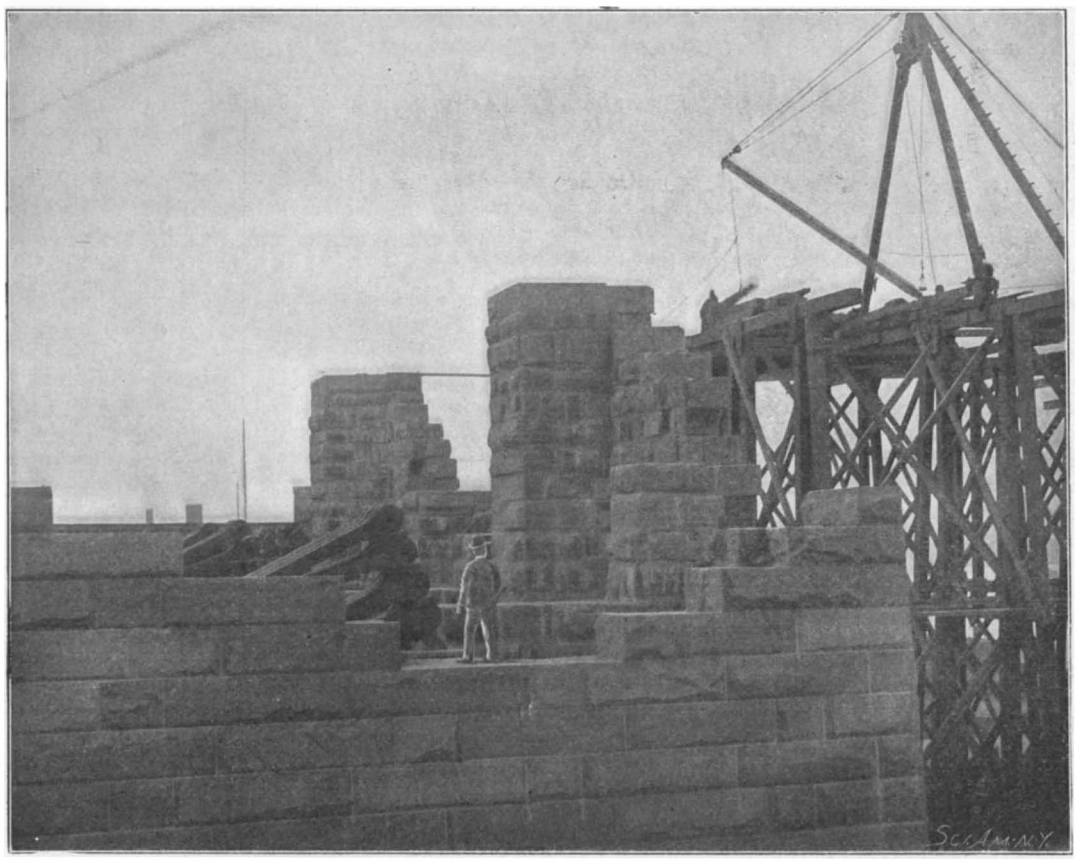
While the world's production has increased with startling rapidity during the century, that of North America has by far outgrown all other parts of the world. In the matter of consumption figures are equally interesting. The consumption of copper in England, France, Germany and North America was 400,583 tons in 1899, against 268,447 tons in 1893, being an increase of about 50 per cent during the period under consideration, while in North America alone the production is given at 77,433 tons in 1893 and 162,000 tons in 1899, the growth being over 100 per cent during that period.

TRIALS have recently been made on the section of the London Metropolitan Railway which has been equipped electrically from Earl's Court to Kensington. The Board of Trade will pronounce upon the merits of the scheme.

THE TOWERS AND APPROACHES OF THE NEW EAST RIVER BRIDGE.

The new East River Bridge, whose progress has been considerably delayed by the lack of structural material, is now making very satisfactory progress. The great masses of masonry which form the cable anchorages at each end of the bridge are nearly completed, and the steel work of the two towers has been carried up to the level of the floor of the bridge. The false-work upon which the portion of the bridge between the towers and the abutments will be erected, has been put up, and unless there is further delay in the shipment of steel work from the rolling mills, it is likely that the towers and the shore span of the bridge will be completed some time during the summer.

If not the handsomest, the new bridge will be at least the largest and stiffest of the notable suspension bridges of the world. Its entire length between terminals will be 7,200 feet; the length of the suspended span will be 1,600 feet, a few feet greater than that of the Brooklyn Bridge, while the extreme width of the floor between the outside railings of the bridge will be 118 feet. Provision will be made for four trolley tracks and two elevated railway tracks, all of which will be carried between the two stiffening trusses, 50 feet deep, which will run the entire length of the bridge from anchorage to anchorage. On the outside of these trusses, carried upon a cantilever extension of the floor-beams, will be two 18-foot roadways. Between the trusses and above the trolley tracks will be two bicycle tracks, each about 8 feet in width, and two 12-foot promenades, there being a promenade and a bicycle track on each side of the center line of the bridge, those on one side accommodating travel from Brooklyn to New York, those on the other reserved for travel in the opposite direction. The foundations of the towers, four in number, are timber and concrete caissons, sunk in every case until they rest upon bed-rock. Above these are solid masonry piers, two for each tower, the top course of the masonry being 23 feet above mean highwater of the East River. Upon each pier are laid four massive pedestal blocks of dressed granite, one at each corner. These blocks are not visible in our engraving as they have been boarded up to protect them from disfigurement during the erection of the towers. Upon the pedestal blocks are placed the heavy column pedestals, massive castings which measure 11 feet by 11 feet on the base and about 8 feet by 8 feet on the upper face; they are 3½ feet in depth and they are strengthened with a mass of intersecting 2-inch vertical ribs.



TOP OF BROOKLYN ANCHORAGE, EAST RIVER BRIDGE, SHOWING END OF ANCHOR CHAINS TO WHICH MAIN CABLES WILL BE ATTACHED.

Immediately upon these pedestals are erected the four massive legs or columns which go to make up each half of the tower; they are square in section, measuring 8 feet on the side at the base, and tapering in the first 20 feet of their height to a square section measuring 4 feet by 4 feet, which they maintain throughout their full height. The massing of metal at the foot of the columns presents an interesting study. They are built up chiefly of ⅞-inch steel plates, stiffened by eight diaphragms which are disposed two on each inner face of the column. The columns throughout their full height, of over 310 feet, are built up of two thicknesses of plate, the total thickness of the metal at the base of column being 1½ inches, and at the top of the column from 1¼ to 1½ inches. The two thicknesses are thoroughly riveted together and the stiffening diaphragms which are worked in at the base of the column are replaced in the upper 4-foot section of the tower by eight built-up Z-bars, two on each interior face of the column. The distance, transversely of the bridge, from center to center of the columns is 24 feet, and they are spaced 40 feet apart, measured in the direction of the axis of the bridge. The four columns of each tower are carried up vertically and parallel as far as the level of the roadway. This portion of the towers has been completed and the summit of the steel-work as seen in our engraving represents, approximately, the roadway level,

Above the roadway the towers will have a sharp inward batter, the inclination being 14 feet in a height of 215. The four columns are strongly braced together, the bracing being built up of heavy angles and tie-plates. Immediately below the floor of the bridge a system of massive lattice-bracing is run entirely around each tower, and extends also between the towers themselves. Similar lattice trusses will extend from tower to tower between the inner legs above the roadway. Additional stiffness and a pleasing architectural effect will be gained by the construction of a stiffening arch immediately below the roadway. The saddle castings, each of which is about 7 feet 8 inches in width by 19 feet in length, and weighs 32½ tons, will be placed immediately over the legs of the columns, a system of heavy column girders, 7 feet in depth, being interposed between the columns and the saddle castings. These girders will extend transversely from tower to tower, and will serve to give great rigidity at this point.

The erection of the towers is being carried on by means of timber false-work, whose construction is clearly shown in our larger front-page engraving. This false-work rests upon the masonry piers and is stiffened by being fastened to the tower itself and by a liberal use of wire cables with turn-buckle adjustments. The lighter material is brought to the tower over a trestle which is built out from the shore; while the heavier material, which in the case of the column footings weighed as much as 12 tons, and in the case of the bottom tapered sections of the tower, as much as 24 tons, was brought to the work upon lighters and picked up and placed in position by means of derricks, which at first were operated from lighters, but subsequently were rigged upon the top of the tower false-work.

Simultaneously with the erection of the towers, work is being pushed on the construction of that portion of the bridge which lies between the anchorages and the towers. Unlike the Brooklyn Bridge, this portion of the roadway will not be supported from the cables. The trusses at their inshore end will rest upon the masonry anchorages, but at the bridge they will be supported upon massive rocker bents which will rest by means of hinged bearings upon heavy girders built into the structure of the tower. Midway between the towers and the anchorages will be an intermediate tower upon which the trusses will rest by means of a combination hinge-and-roller bearing. The main span between the towers will, of course, be carried by the main cables, except for the first 100 feet or so at the tower, which will receive a cantilever support from that portion of the truss which extends from the main tower to the intermediate tower. Unlike the stiffening trusses of the Brooklyn Bridge, the new East River trusses will not be cut at any point, or contain any slip-joints, but will be continuous from anchorage to anchorage; moreover, they will not be anchored rigidly either to the towers or to the anchorages. As we have already pointed out, they will be provided with roller bearings at the anchorages and at the intermediate towers, and with rocker shaft bearings at the main towers; consequently, being higher at the center than at the ends, they will expand evenly and freely from the center toward the anchorages on either shore.

IT is estimated that at the present rate of consumption there is pine enough in Northern Minnesota to last from thirty-five to forty years. With a reasonable conservation of the forests, the establishment of a Northern Minnesota forest park, and the adoption of forestry, systematically undertaken, as is now proposed, the Northern Minnesota woods should furnish timber and a revenue to the commonwealth for an unlimited time.

Science Notes.

A train recently carried fifty-nine car loads of oranges from California east. There were in all 21,712 boxes.

In 1806 James Watt built an organ for St. Andrew's Church, Glasgow, which he attended. There was considerable opposition to its use, and many caricatures were published concerning it.

A committee of the Senate is now investigating the alleged deleterious action of alum as a constitutent of baking powder, which was demonstrated many years ago in England. Small amounts of alum improved the appearance of bread made from inferior flour, but the product was prejudicial to the health of the consumers and its employment was prohibited by law.

On June 23 next, a festival will be held at Mayence to commemorate the 500th anniversary of the birth of Gutenberg, the reputed inventor of the art of printing. In this festival almost all civilized nations will take part, and it is to be hoped that the United States will be duly represented. In connection with this festival the foundations of a Gutenberg Museum is planned.

Arrangements are being considered for an exhibition of paintings to be shown at New York in aid of the Naval Arch Fund, the paintings to be American works, which were exhibited at the Paris Exhibition. The Board of Aldermen have directed that a sufficient amount of money be appropriated to preserve the arch for one year, and the care of it was assigned to the Commissioner of Buildings.

Plants containing hydrocyanic acid have been investigated with a view of determining the part played by this substance in the vital economy of the plant. He concludes that cyanogen compounds are transitional substances from which plants obtained their nitrogenous food materials. At the same time when the seeds begin to swell, as long as the embryo is dormant, the bitter almond contains no trace of hydrocyanic acid. It makes its appearance only in the stem, not in the root, nor in the cotyledons.

Prof. Trowbridge has perfected a new method of obtaining X-rays. The currents of electricity which have hitherto been used in making photographs have been fluctuating, making the pictures of uncertain value to surgeons. Prof. Trowbridge, of Cambridge, has succeeded in getting a steady current, and the pictures taken by his new system are remarkable for the clear and distinct outlines of the muscles and bones of the subject. To all appearances, the discovery will be of the greatest use to surgeons and in the study of anatomy.

An interesting telescope has just been put in position at Potsdam. It is a duplicate instrument, being composed of two tubes, side by side, the larger one for photographic purposes and the other is to be used visually and as an aid to keeping the star images stationary upon the plate during long exposures. The photographic one has a diameter of 32 inches and a focal length of 40 feet. The visual objective is slightly longer in focus, being 41½ feet, and is 20 inches in diameter. For this instrument, which will be employed to determine the motion of the stars in the line of sight by means of the spectroscope, a special dome has been built.

A celebrated American astronomer suffered acutely for over twelve years from an unknown trouble in his leg. The surgeons did not seem to be able to diagnose his case. He finally went to the Johns Hopkins Hospital at Baltimore, and an examination by two young surgeons showed that the lameness was due to a diseased nerve in the leg. The patient was told that the operation would be painful, and in the nature of an experiment, as it had been tried only once before, in France, in which instance it was successful. The patient refused to take anæsthetics, as he desired to witness the operation as far as possible. The leg was opened and the nerve was found to be diseased, and the patient directed the surgeons to cut it out. The nerve was entirely removed, the wound closed and in ten days the patient was able to dress himself and walk about the hospital, and he is now able to go up and down stairs and walk half a mile at a time.

The accumulated files of newspapers have encroached very largely upon the space at the disposal of the authorities of the British Museum. The shelves occupied by London newspapers alone exceed 1,000 yards in length, while those devoted to the provincial, colonial and foreign numbers measure more than 3,000 yards, the total being close upon 3 miles. In a single year the British newspapers have been known to fill 111 yards of shelving, which is at the rate of 1 mile in sixteen years. Of course such a progress cannot be prolonged indefinitely. A bill is now before Parliament, which will authorize the trustees to deposit with local authorities any local newspapers which have been received by them at Bloomsbury since the year 1837, or which may be hereafter received, and also to make rules respecting the disposal by destruction or otherwise of printed matter deposited in the museum which is not of sufficient value to justify its preservation.

Electrical Notes.

An electric railway is now running between the north and south extremities of Berlin. The length of the line is 15,180 meters.

A submarine telephone cable has been laid through the Straits of Mackinac connecting Marquette with Detroit and other cities.

The Roentgen Society of the United States was organized in St. Louis on March 31, for the encouragement of the study of the X-rays and their use in medicine and the arts.

The street railways of Havana are to change the motive power from horses to electricity. The city is in great need of rapid transit, and the delay in the new improvements is caused by putting down new sewers, etc.

The suburban service between Paris and Versailles is to be operated by electricity. Steam locomotives are to be abandoned and electric motors substituted. The power station will be equidistant between the two places

According to Prof. Borchers, says The Engineer, the world's manufacture of calcium carbide is utilizing a power equal to 180,000 horse power, that of alkalies and combinations of chlorine, 56,000 horse power; aluminium, 27,000 horse power; copper, 11,000 horse power; carborundum, 2,600 horse power.

The Volta School in Naples has 400 scholars, they provide their own tools and go through courses in electricity, chemistry and mechanics. The pupils pay a nominal fee and the institution is assisted by the government and by the city. It is said that it is easy to obtain employment on leaving the schools.

The telephone has proved very successful in the West in places where different farmhouses are connected by wire, as it enables them to give each other timely warning of the approach of tramps. It is also useful in cases of fire and sickness. The possibilities of the telephone in rural districts are very great.

A curious accident occurred in Sheffield, England. A passenger was riding on a double-deck electrical car, and a single-deck car passed in the opposite direction. The rope of the trolley boom of the latter was flying in the wind, and it wound itself around the passenger's neck. Fortunately, he had the presence of mind to seize the rope with both hands and release himself, or he would have probably been pulled from the car.

The result of draw-bar tests taken on the South London Electric Railway, says The Engineer, shows that the tractive resistance per ton of train is 40 pounds at that moment of starting, and that it drops quickly to 10 pounds at 6 miles. Between 6 and 13 miles per hour the resistance remains constant, and then continues to rise almost proportionately, to the speed until 26 miles per hour is reached, when the resistance is about 21 pounds per ton.

The underground-electric railway at the Paris Exposition will not be in use for some time to come. The trial, will now be held on May 15. Carriages of the corridor pattern will accommodate fifty, and each will be lighted by ten electric lights. Separate doors for the entrance and egress of the passengers are to be provided. The run of nine miles from Vincennes to the Bois de Boulogne is to be accomplished in twenty-seven minutes, including stoppages.

Tho fire marshal of a Western city has just tested an automatic fire alarm, by which messages are sent over the telephone automatically with the aid of a phonograph, at intervals in the different rooms. Thermostates are provided. As soon as the rooms attain a certain temperature, these thermostats cause the phonograph to be switched over in front of the transmitter and recorded sentences are ground out over the telephone. The phonograph will continue to repeat the location of the fire until it is shut off.

Mt. Blanc Observatory is connected with the Grands-Mulets by telegraph wires and the naked wires are permitted to lie directly upon the surface of the glacier without any support or insulation. The wires are the regular French government standard, of galvanized iron, and no insulation was used even where they came in contact with the rocks. The results of many tests show that the insulation was almost perfect. The results of these experiments while, perhaps, limited in application, says The Engineering Magazine, may be of much importance in mountain exploration work.

A machine has been provided for automatically cleaning shoes. The foot is inserted into a properly arranged opening and the railing of the machine is firmly grasped. A small motor actuate rotary brushes that removes the mud. The foot is next placed in the blacking arrangement proper, which acts as the dauber and the third set of brushes is devoted to polishing. One shoe having been sufficiently polished the other foot is then inserted in the first aperture, etc. A needle on a machine indicates the various stages in the operation. The only precaution to be observed is to turn up the bottom of the trousers sufficiently so that they will not be caught in the rotating brushes.

Archæological News.

Lanciani has shown that a law was passed in Rome at the time of the Cæsars restricting the height of the fronts of buildings to 60 feet. Augustus, Trajan and Nero regulated the heights of buildings. Augustus fixed the height at 70 feet, Trajan at 60 feet and Nero at the same height.

An appeal has been made to archæologists and others, who are interested in Christian antiquities to subscribe toward the further exploration of the Catacombs. The Commissioner of Sacred Archæology has been performing an excellent work in continuing the excavations where De Rossi ended the work. The present Pope, Leo XIII., has aided the work generously, but the means at the disposal of the commission are still inadequate. Of the forty-five cemeteries, only about five are at present accessible to the visitor to Rome.

Experts of acknowledged reputation have been engaged by the University of California to make explorations and excavations in parts of the world which are rich with relics of ancient learning. The entire expenses will be borne by Mrs. Phœbe A. Hearst. The material collected by the archæologists will be placed in the archæological museum which will be established at Berkeley. Dr. George A. Rosiner will have charge of the explorations in Egypt. Dr. Uhle will pursue investigations in South America, Yucatan, California, and New Mexico. New Mexico will be searched for specimens by Dr. Philip Mills Jones. Dr. Alfred Emerson, recently professor in the School of Archæology at Athens, will work in Greece and Etruria.

Among the objects found by Schliemann at Troy and Mycenæ are a number of amber trinkets. As amber is derived from the shores of the Baltic the question arises whether the trinkets were made of true amber or of fossil copal of African origin brought to Troy by the Egyptains and Phœnicians. They have been found, however, to be true amber by a simple test based on the fact that amber contains sulphur, whereas copal does not. A small particle is placed in a test tube and heated until the fumes are given off, and allowing the fumes to come into contact with a piece of moistened lead acetate test paper, the characteristic black color will be given if the specimen is amber, but with copal no such color will be obtained.

Roman Christian monuments of historical interest are now receiving a fair share of attention, both from public institutions and private individuals. Prof. Lanciani has recently given an interesting account of some of the recent discoveries relating to Christian Rome. There has been a Roman house discovered under the church of St. Cecilia; Santa Maria in Cosmedin has been reopened and has been restored in a scientific archæological sense, and the same process will be followed in connection with the churches of St. Maria in Aracœli and S. Saba. The underground church of SS. Petronilla, Nereus and Achilles was restored and was inaugurated on May 14 last. The columns of the Narthex have been set up again on their bases, the enclosure of Schola Cantorum restored, the tombstones set in the pavements have been made visible again, and the walls of the aisles turned into a local epigraphic museum.

A large well, with its mouth sharply cut in the Etruscan manner, has been discovered in connection with the Forum excavations. Five of the broken columns of the Æmilian Basilica are being pieced together, and the opinion now gains among serious students that when Pliny wrote "Phrygian" he intended the marble nowadays called "Africano." Not a single chip of Phrygian marble has been found during the excavations on this site, while the other precious marble has literally abounded, and here are columns of it belonging to the inner naves of the building. This is rather a blow to those who have theorized, says The Builders' Journal, that the columns of former Basilica of S. Paolo outside the walls had been taken from the Æmilian Basilica in the Forum. The fact is that the columns destroyed in that church in 1823 by fire were of a dimension far larger than even those of the outer porticoes of this pagan Basilica.

An interesting discovery has recently be made by M. George Seure, of the French Archæological School at Athens, in the shape of a Thracian triumphal car of the later Roman period, or about the fourth century A. D. It was excavated in the tumulus at the foot of Rhodopes, near the village of Pastousha, situated southwest of Philippolis. Here were probably buried the servants and belongings of some great general who evidently fell in some battle nearby. All the metallic fittings of the chariot, with small bronze figures as decorations, and the harness for one horse, were found, together with human skulls and several semi-decayed swords and lances. The whole has been put together, and the complete chariot is now on exhibition. The Bulgarian government has been greatly pleased by the archæological researches in the country and Prince Ferdinand has contributed 10,000 francs from his private purse and the Bulgarian government has added $5,000 more to help along the work.

THE CHILDREN'S MUSEUM OF BROOKLYN INSTITUTE.

In the spring of 1899, Prof. W. H. Goodyear, the Curator of Fine Arts of the Museum of the Brooklyn Institute of Arts and Sciences, suggested to the Board of Trustees and the Council of the Institute that a "children's museum" be established in a building of which the Brooklyn Institute had the use. The Institute has been for many years engaged, through its several departments and sections, in making museum collections and libraries, and in giving instructions by lectures and courses of study on many subjects, and it has also established, under the auspices of its Department of Pedagogy a pedagogical museum and library, which will represent the history of education from the earliest times, and will illustrate the equipment of schools and colleges in the work of giving instruction. The establishment of the museum which is especially adapted to the interests of young people between the ages of six and twenty years, has never before been attempted on any extensive or carefully devised plan, and the present museum which has been started will prove a most interesting model for similar institutions.

It is the purpose of the children's museum to build up gradually for the children of Brooklyn and the surrounding neighborhood a collection that will delight and instruct the children who visit it; to bring together collections in every branch of natural history that is calculated to interest children, and to stimulate their powers of observation and reflection; and to illustrate, by collections of pictures, cartoons, charts, models, and maps, each of the important branches of knowledge which are taught in the elementary schools. The museum, through its collections, library, curator and assistants, attempts to bring the child or young person, whether attending school or not, into direct relation with the most important subjects that appeal to the interest of their daily life, in their school work, in the reading, in their games and rambles in the fields, and in the industries which are carried on about them.

The building is situated in what is known as Bedford Park, and thus has advantages of light and air. It was an old house of generous proportions which, after being remodeled, redecorated and lighted by the electric light, forms an almost ideal building for a museum of this kind where the rooms should not be too large. On the ground floor are six rooms devoted to exhibition purposes, and on the second floor is the library and curator's office. These rooms are known as the model room, animal room, plant room, anatomical room, meteorological room and lecture room. The rooms are charmingly decorated in different colors, and all of the cases are of proper height so that the children can obtain excellent views of the various collections.

In the model room we find collections illustrating crystalography, the mineral crystals being placed in conjunction with models of crystal. Here will be collections of the useful ores, useful minerals, a collection of drift rocks of Long Island and similar collections Island, and special efforts is made to interest the children and young people in the fauna and flora and mineralogy of the immediate neighborhood in which they live. Probably the most interesting collection in the room is a small "type" collection which is considerably used in France for elementary schools. It consists of a number of real specimens. There are 35 minerals, 13 fossils, 10 recent mollusca, 90 insects, 2 crustaceans, 20 plants, 2 fishes, 3 birds, 3 worms, 3 radiates, 3 reptiles and 2 mammals, making, a total of 185 specimens. This interesting collection is sold in France for $20, and it seems as though every school in the country might possess a type collection of this kind. The specimens are excellent. Thus, we have a mounted bat, handsomely stuffed birds, and a snake a foot long.

THE ANIMAL ROOM IN THE CHILDREN'S MUSEUM.

The charts hung around the room refer to useful woods, vegetable products, cereals, alimentary plants, gums and resins, minerals, textile fabrics, fertilizers, geology, mineralogy, and the manfacture of gas, etc. Take for example the latter; here we find the forms of coal illustrated, showing the Devonian plants, then diagrams showing the production of gas, samples of by-products in little bottles, etc. In the animal room there are a large number of interesting models of extinct monsters. Thus, the one shown in our engraving, the "mastadon longirostris" of the Tertiary of Europe, is two feet long, and the other animals are in about the same proportion. One of our engravings shows the case holding the extinct animals, and also some of the charts upon the walls and the small busts upon the mantel show various types of races. In another case, in the same room, are models of animals which now exist. In the same room are charts illustrating the various food industries, manufacture of textiles, etc. Thus, for example, we have a chart showing the leather industry, and attached to the stiff cardboard is a sample of hide taken from the animal, the various tanning materials, coloring materials, the dyeing and finally the bristles and the manufacture of brushes.

The botanical and flower room contains, in addition to the charts, some forty-two large flower models which can all be dissected. In a case in the center of the room is a collection of Long Island lepidoptera, and the life history of the honey bee. In a case to the left will be seen some of the many microscopes owned by the Institute. It also shows the height of most of the cases, and also how effective these charts, which are not at all expensive, can be made in the decoration of a schoolroom. In the anatomical room, will be found some very large and handsome models such as the human heart, shown in our engraving, articulated and dissected. Here will be found the ear and other parts of the human anatomy. The lecture room seats forty, and it is provided with an electric lantern for projecting lantern slides upon the screen, arrangements being provided for making the room semi-dark, thus enabling the lecturer to see the children at all times and keep them under control. With the electric light the images are bright enough for all ordinary purposes. Around the room are various charts and models, and there is a lecture platform at the sides of which are cases containing chemicals, so that simple experiments, such as the chemistry of digestion, can be carried on. It is intended to have teachers from the various schools bring their pupils to this room where they can lecture, using the splendid collection of material at hand. Of course, the large proportion of lectures will be given by the curator, Prof. R. Ellsworth Call, M.D., M.Sc., Ph.D., who is very enthusiastic concerning the work of the children's museum, and he has added largely to its collection. In the course of a few months Dr. Call anticipates that all the specimens will be labeled, and that he will be in a position to bring the museum into an even greater state of efficiency that it now is.

In the lecture room there is a map of France on which the natural resources and manufactures are indicated by small specimens attached to it. Thus, the wine-growing sections of the country are indicated by small bottles of wine; coal which is admirably distributed all over the country is indicated by a number of small pieces of coal wired on to the chart; shipping is indicated by little metal ships; glass manufacture by a small piece of glass, etc. Dr. Call is at present working on a chart of the United States on approximately the same lines. There are at the present time a number of meteorological instruments installed in the tower of the building, and in one of the lower rooms are samples of all of the charts issued by the Weather Bureau. A self-recording anemometer is connected electrically with the revolving disks upon the roof. There are also self-recording thermographs, a barograph, a self-recording thermometer, and a standard barometer. There are also collections illustrating geography, history, etc.

In a few words the scope of the children's museum may be said to include the great round of human endeavor and of human interest, so far as they appeal to the child, or so far as they may be made to subserve the cause of education of youth. Its collections are all selective and have a real definite relation to the home and school life of the child.

They are all labeled with great care, special attention being paid to simplicity, without departing in any degree from scientific accuracy. Upon the walls are many charts, and altogether there are 900 charts exposed to view and kept in the chart rooms. They can be changed at will and are most interesting, embracing nearly all of the subjects of science as well as most of the useful arts. Some of them will be referred to later. In the model room will be found a splendid series of twenty-four anatomical models. Thus, we find a silkworm, 5 feet long, executed in papier mache; it can be separated, and the wonderful process of spinning the delicate fibers can be explained by reference to such a model to quite a large audience, because of the very considerable size of the model. The edible snail which is shown in our engraving, articulated and dissected, is 3½ feet long, and is a splendid example of the art of papier mache working. These models, are, of course, colored to give the appearance of life. In this room will also be found a special collection of shells of Long

A CORNER IN THE BOTANICAL ROOM OF THE CHILDREN'S MUSEUM.

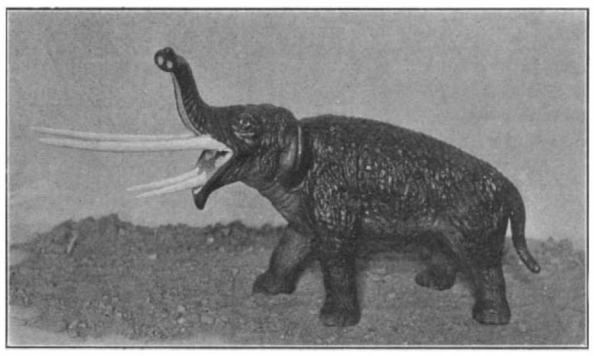
THE nearest settlement to Cape Nome prior to 1899, was St. Michael, 100 miles to the southeast, which is the starting place of steamers for the Yukon River.

The United States Biological Survey.

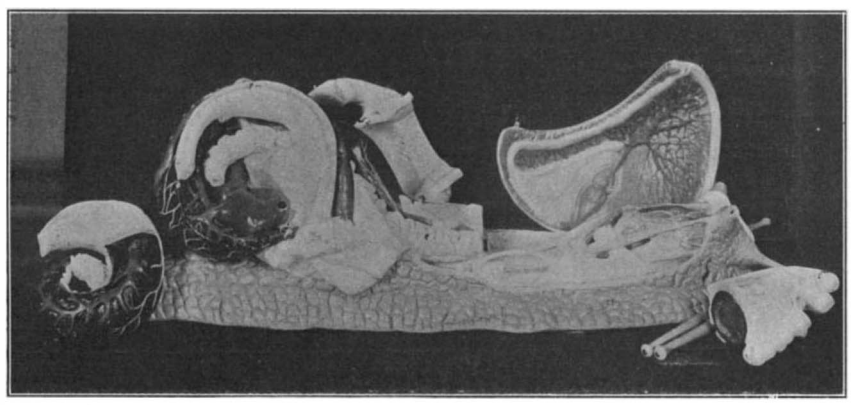
The work carried on by the Division of Biological Survey of the United States Department of Agriculture is most important, and the methods employed and the results obtained are of great interest. During the fiscal year of 1898–99 work was carried on in several states and territories, and also in British Columbia and the Northwest territories. Under the personal supervision of Dr. C. Hart Merriam, camps were occupied on Mount Shasta from July 15 to October 3, 1898. The peak was completely encircled, the several life zones were outlined with great care, and data were secured regarding the distribution of characteristic mammals, birds and plants, and many side trips were taken; and in the spring of 1899, supplementary collections were made with a view to covering the entire northern part of California and extending the biological reconnoissance southwest. The discovery of gold in the Klondike region and several points in Alaska has aroused general interest in the resources of the territory, and the rush of miners and emigrants to the new gold fields brought about rapid development in the means of communication to the Upper Yukon. The regions, which were practically inaccessible, can now be explored with comparatively little difficulty. It was, therefore, deemed desirable to begin systematic work in Alaska during the summer of 1899, and through the courtesy of Edward H. Harriman, Esq., of New York, an invitation was extended to the Biological Survey to join an expedition he had fitted out at his own expense for a trip along the Alaskan coast. Dr. C. Hart Merriam with two assistants accepted the invitation and spent two months in active field work at numerous localities, most of which are out of the regular routes of travel. The steamer which had been chartered was fitted up with all necessary appliances for scientific work, and offered unusual facilities for the collection and preparation of the material. The results obtained were most satisfactory, and as the Upper Yukon is practically unexplored field, a systematic study of the fauna along its whole course aided in throwing much light on the northern limits of the ranges of many species. As a party was also detailed to work down the Yukon River, the practically simultaneous exploration of the coast and interior, promises to offer important data for mapping the life zones in South Alaska, which will be most useful.

The subject of the economic relations of birds has been very carefully investigated by the division, and during the year 1381 birds' stomachs were received and 1961 were examined in the laboratory. The total number of birds' stomachs in the collection amounts to 31,300, and represents the accumulation of fourteen years. These stomachs, of course, offer valuable information upon the food of the various birds in their relation to crops; for instance, complaint is made of the depredations of the blackbird which breeds in enormous numbers in the swamps of the Upper Mississippi Valley and destroys considerable grain in the early autumn. The material now on hand shows definitely the damage done by each species, and also the members of the group which offset their grain-eating record by the destruction of insects. In addition to the examination of the stomachs of the birds in the laboratory, a great deal of work has been done in the field to ascertain whether birds show marked preference in selecting a food, or simply that which is most abundant, or most readily obtainable. Stomach examination shows what kind of food a bird has eaten, but it is desirable to know whether birds habitually reject other kinds of food, especially insects, which are equally abundant. By the careful examination made on a farm, it is believed to be possible to determine the effect of the birds on the crop at each season of the year.

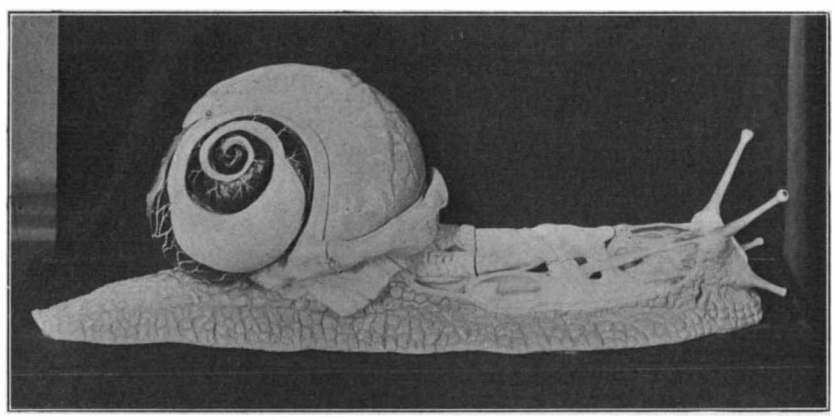
Compilation and tabulation of data for mapping geographical distribution have continued practically without interruption during the year. Similar data has also been tabulated for mammals, as far as means were available. Many specimens have been received for identification as in former years, but the fact that the division is willing to identify specimens of mammals and birds, and that such material can be forwarded to the department by mail and returned free of expense to the sender, does not seem to be as generally known as it should. The farmer or the fruit grower thus has an easy way of learning the name of the unfamiliar bird which is suspected of damaging his grain or fruit, and, moreover, this work tends to stimulate observation and study of habits of animals and birds, and thus has an educational value. The introduction of "nature study" in the common schools and the efforts of the Audubon societies in the cause of bird protection, are responsible in a large measure for the extraordinary popular interest in bird study which has developed in the past few years. Under the leadership of the College of Agriculture of Cornell University, this novel kind of school work has made wonderful progress in New York, and has also been successfully taken up in other States. Children are so easily interested in birds that elementary ornithology has deservedly become one of the most popular branches of nature study, and its introduction into the lower grades of the public schools opens a wide field for teaching the economic side of the subject, as well as for correcting erroneous ideas now prevalent respecting the value of certain birds. One of the first suggestions for popularizing nature study was the observance of a bird day in the schools, and since this suggestion was endorsed by the department in 1894, the observance of bird day in connection with arbor day has been provided for by law in at least three States, Wisconsin, Minnesota and Connecticut, and has been adopted by many schools in other parts of the country. Of course the lack of the requisite knowledge on this subject on the part of the teachers, offers an obstacle to the success of bird study. It is said that 70,000 text books on birds have been sold by New York and Boston publishers during the last six years, and in the same time more than 200,000 copies of circulars and reports relating to birds have been distributed by the Department of Agriculture. Reports fresh from the press find their way into the schools and are almost immediately utilized in instruction. The Farmers' Bulletin on "Common Birds in Relation to Agriculture" has been reprinted six times, and 140,000 copies have been published. All these things help the public in becoming interested in birds, and also to the appreciation of their value to agriculture.



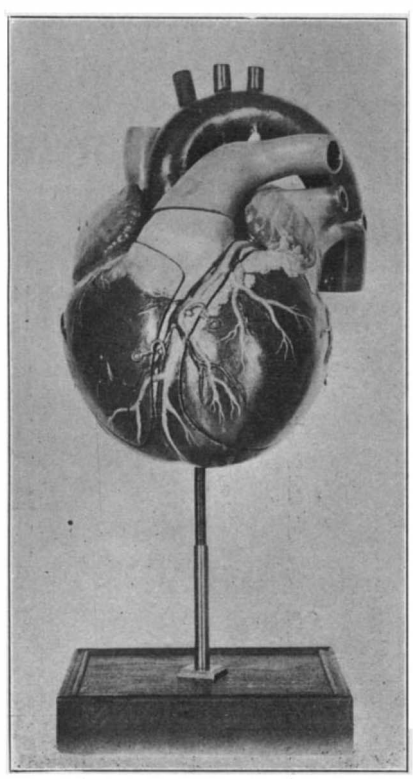
MODEL OF EXTINCT ANIMAL.



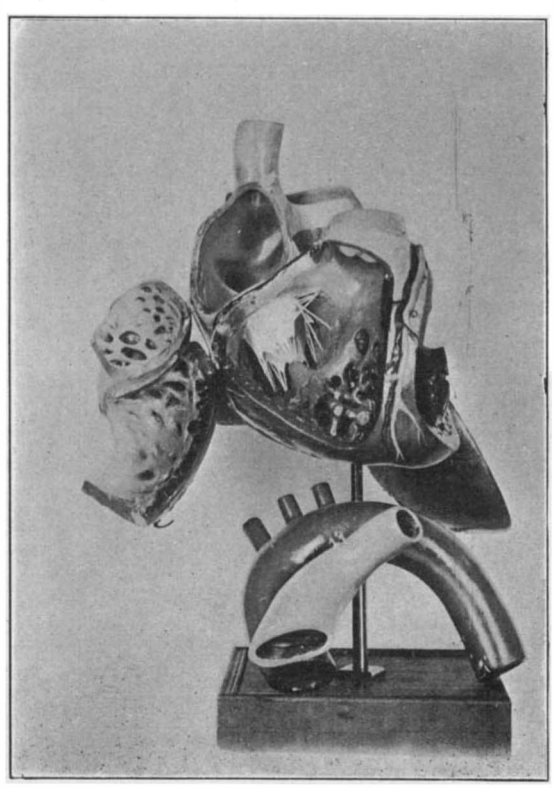
THE SNAIL DISSECTED.



MODEL OF SNAIL, THREE FEET LONG.



MODEL OF HUMAN HEART.



HUMAN HEART DISSECTED.

Measures designed for the suppression of injurious animals and birds have been considered by the Legislatures of fully a quarter of the States of the Union during the during the past year, and results are that many bounties have been offered. Bounty legislation in the United States dates back until 1630, and during these two centuries and a half, more than 400 separate laws have been passed containing every conceivable provision for securing proper enforcement, avoiding fraud and raising funds with which to pay rewards.

The English sparrow has attracted unusual attention during the year on account of the efforts made in Boston by the American Society of Bird Restoration to clear the sparrows from the Common in Public Garden. On March 15, five men in charge of a foreman, began to tear down the nests in the trees and buildings on the Common, and to close up the holes which had been used as nesting sites. During three weeks the work was carried on, when 1,000 sparrow eggs and 4,000 nests were destroyed, and 5,000 holes were closed. On April 5, the Mayor stopped the work, and on April 14 there were a hundred nests, on May 22 152 nests, and it was estimated that less than 450 birds were breeding there. The nest destruction aroused a storm of opposition. Numerous protests appeared in the papers and the department was flooded with letters. Unfortunately the experiment was not continued long enough to secure definite results, or to test this method of preventing the undue increase of the sparrow. The movement accomplished some good, however, not only in Boston, but elsewhere. The necessity for legislation restricting the introduction of noxious animals and birds is emphasized in the report of Acting Chief T. S. Palmer. The danger of introducing certain Old World mammals, and birds is neither imaginary, nor of slight importance. The experience with the English sparrow shows this clearly, and the loss which have resulted from the introduction of the rabbit, the weasel, the English sparrow, starling and blackbird in New Zealand and the colonies of Eastern Australia has amounted to millions of dollars.

AT Bosco Reale on the slope of Vesuvius, near Pompeii, where the great silver treasure was found a few years ago, recent excavations have brought to light some of the most remarkable paintings of the Roman period yet discovered. In the grounds of the Del Prisco villa a great peristyle and four large rooms have been unearthed, the walls of which are covered by twenty large frescoes of rich coloring and more careful execution than any hitherto known. The figures are of life size. It is to be hoped that some process will be discovered to preserve them more satisfactorily than those at Pompeii and in the Naples Museum.

TALL OFFICE BUILDING MODEL FOR THE WORLD'S FAIR.

The many-storied office building, with its skeleton of steel and paneling of brick, stone and glass, is essentially an American production. It is pretty generally admitted that the composite building originated in this country, and whether it did or not, it is certain that its structural possibilities, as exemplified in the towering structures at the lower end of Manhattan Island, have been developed and demonstrated almost exclusively on this side of the Atlantic. The construction of the very remarkable model, which forms the subject of our illustration, is due to the desire of the Western Society of Civil Engineers to adequately represent the branches of engineering which are concerned in tall office building erection, at the Paris Exposition. At the request of the society, Mr. Corydon T. Purdy, of this city, undertook the work of getting up a suitable exhibit, and to this end selected the Broadway Chambers office building, as being one of the very latest structures of the kind to be erected, and as being thoroughly representative of the best class of construction. The plans of the building were furnished to Mr. H. C. Hinchcliff, of this city, who undertook to construct a model on the scale of half an inch to the foot, or one-twenty-fourth of the real size for the sum of $5,000.

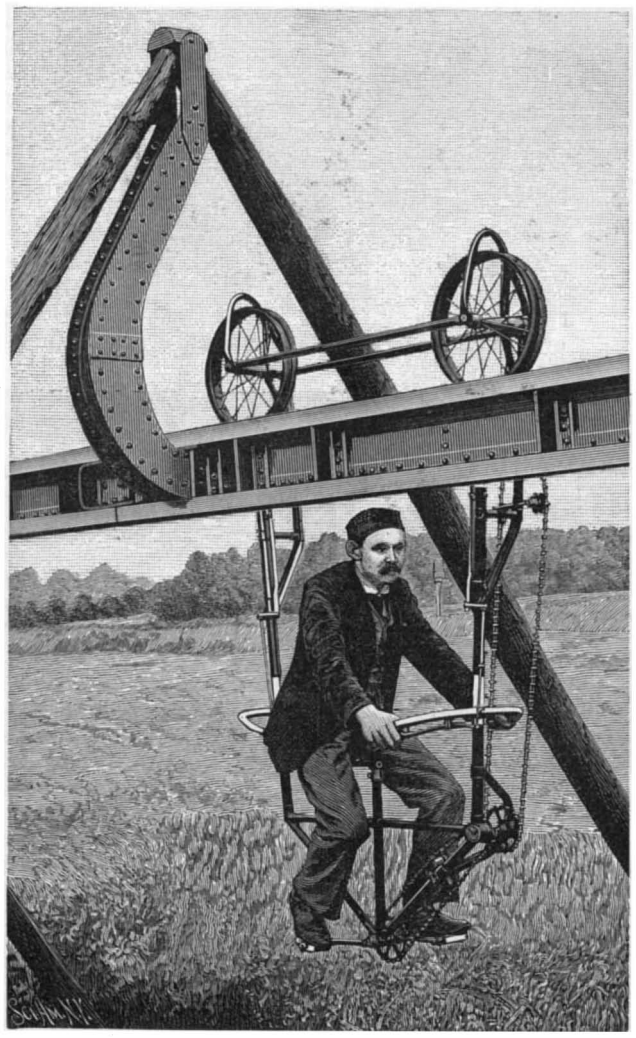
The model stands about 12 feet high, and weighs altogether about 2,300 pounds. 1,500 pounds being the weight of the base and 800 pounds representing the weight of the brass out of which the whole of the I-beams and columns have been constructed. The model contains altogether 30,000 separate pieces, the extraordinarily large number being explained by the fact that not only does the model represent each column, I-beam and girder in the structure, but each of these members is built up of as many separate pieces of sheet brass as there are separate pieces of steel in the completed building. Thus, for instance, where a main column is built up of say two web plates, two cover plates, and a certain number of angles, the model faithfully represents both in shape, thickness and number, the separate pieces. The joints of the main columns are located in exactly the same positions as they occur in the building itself, and every gusset, stringer, and floor beam is found in the model. Indeed, the only pieces that are wanting are the bolts and rivets which, for obvious reasons, could not be reproduced except at a great increase in the cost. The foundations, as will be seen from the detail view of the model, are faithfully represented, and visitors to the Fair will receive an interesting object lesson in the methods adopted by our engineers to distribute the enormous concentrated loads inseparable from these buildings. The elevator system, without which the tall building would have been impossible, is shown in the model by four beautifully constructed models of the Otis elevator, which are in exact proportion and are capable of being operated. To the right of the elevator is seen the system for supplying water throughout the building, which, in the case of the Broadway structure, is forced up to the various stories by compressed air.

Around the model will be arranged various exhibits, some of them on a full-sized scale, of the different industries which are represented in the construction of a tall office building. One of these exhibits will be a plaster-of-paris model of the structure as completed. Another will be a model of a single office room, showing the fire-proof construction of the floor and partitions, and the general finish and fittings. There will also be models of the electric lighting plant, showing the dynamo-engine, system of electric wiring, and various fixtures. Another exhibit will present the sanitary and plumbing arrangements; another the steam heating; while Carnegie & Company will exhibit some full-sized sections of the steel frame work. After it has served its purpose as an exhibit in Paris, the model is to be used as a selling sample, providing in this respect a better representation of the work than is afforded by a wash drawing and a set of blue prints.

THE Western Locomotive Works is building two locomotive of armor plate steel. The working pressure is to be 225 pounds to the square inch.

THE MONO-RAIL TRACK VELOCIPEDE.

The ordinary track velocipede as used on our standard railways is a familiar object and withal a most useful aid to railway superintendents, road masters and maintenance-of-the-way engineers in the performance of their duties. The ordinary velocipede is a four or three-wheeled affair propelled, in the older forms, by a regulating shaft, operating through levers on the cranks, and in the later forms by regular bicycle chain-and-sprocket driving gear. In the course of the development of the Langen single-rail railway, illustrations of which were given in our last issue, it was realized that a velocipede would prove a particularly convenient means of inspecting the line and moving from one part of the work to another. As it was evident that all the advantages claimed for suspended cars would apply very well to the suspended velocipede, the unique machine shown in the accompanying illustration was constructed, and subsequently proved to be thoroughly practicable.



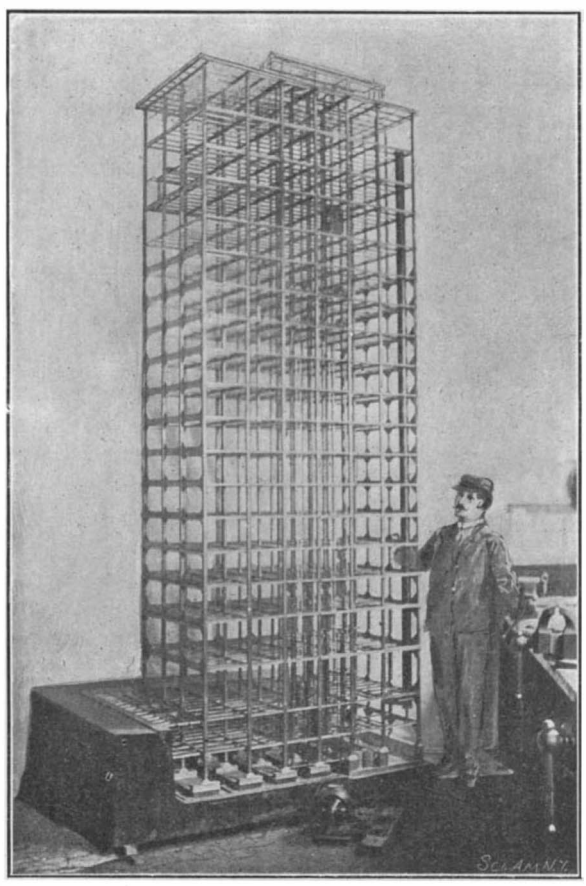
THE MONO-RAIL TRACK VELOCIPEDE.

The suspended railway upon which it is traveling differs considerably from the form adopted on the line through the Wupper Valley. It will be seen that the elevated girder is suspended by means of hook-shaped plate steel supports from the apex of a couple of inclined poles, the hanger resting upon the tops of the poles by means of a pair of plate straps riveted to the hanger and to the saddle. The rail in this case is a continuous built-up I-beam, the upper flange of which forms the track.

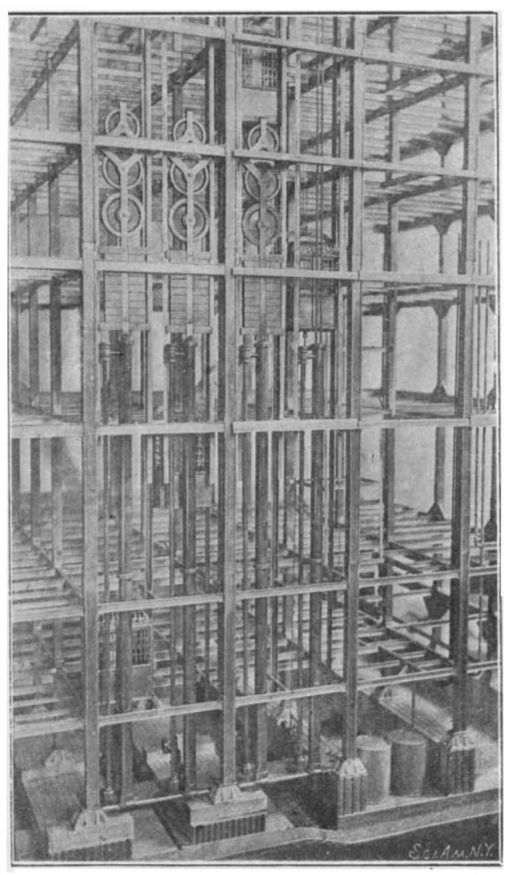
The velocipede is suspended from and forms part of a two-wheeled truck, the forward wheel of which carries on its axle the sprocket which is engaged by the chain drive. The suspended frame is built of bicycle tubing, and its construction is so clearly shown in the engraving as to need no detail description. To enable the machine to be run in either direction, it is provided with two handle-bars, one on each vertical member of the frame, the saddle being reversible in the seat post. Each handle-bar is provided with a brake lever which, by means of sliding rods attached to the vertical members of the frame, enables the rider to press a brake shoe against the under flange of the suspended railway.

Bromide Paper for Amateur's Use.

It is generally believed that the preparation of bromide paper involves great difficulties, and in consequence is practically impossible for the amateur. However, these difficulties are not insurmountable, and with careful and clean operation successful results may be obtained. Besides, the paper thus prepared presents certain advantages over the paper of commerce, for by modifying the composition of the emulsion, the final tone may be varied, and shades from red to sepia and black may be obtained without varying the development. As the same emulsion may be used to give these different tones, one may prepare as much of each color as is necessary. When, for instance, the required amount of paper of black tone has been prepared, the same emulsion may be utilized to obtain other shades by the simple addition of certain chemicals. Mr. Thorne Baker gives the following process, which he has used with success: 2 grammes of Nelson's gelatine No. 1 are swelled in 28 c.c. water; it is more convenient to do this in a graduated measure placed in a cylindrical vessel of larger dimensions. When the gelatine has absolved all the water, it is melted by slightly heating the water in the outer vessel, which is filled to three-quarters the height of the graduate. When the gelatine is melted, 1·2 grammes bromide of ammonium are added, and the mixture introduced into a flask previously rinsed with distilled water, then a solution of 1·7 grammes in 28 c.c. water is added, this latter operation being carried out in the dark-room. The mixture should be well agitated. The emulsion is then heated to 65° C. for ten minutes, then filtered through four layers of fine muslin; it is thus filtered three or four times and then cooled. When completely cool, the emulsion is cut into small pieces and placed upon canvas, the four corners of which are then brought together and the emulsion forced through the canvas. After this operation it should be carefully washed with distilled water, preferably in a funnel suitably arranged for the purpose. The emulsion is then remelted in a porcelain dish placed in a larger vessel containing hot water. To sensitize the paper, it is floated for three minutes upon the emulsion, drained, and dried flat upon blotting paper. The paper thus prepared gives black tones. To obtain brown tones, only 1 gramme of bromide of ammonium is taken, to which is added 0·2 gramme iodide of potassium. The sensitiveness of the paper varies according to the quantity of haloid salts present. For development a dilute bath of hydrochinon, alone or in combination with metal, may be used.



MODEL OF TALL OFFICE BUILDING FOR THE WORLD'S FAIR.
Cost, $5,000. Number of pieces, 30,000.



DETAILS OF FOUNDATIONS, SIDEWALK, AND ELEVATORS.

ACCORDING to The Daily Graphic the backwardness of the authorities in London in adopting the mechanical inventions of the century is most extraordinary. In London the men who clean the street are provided with shovels, pick-axes, antiquated carts and inefficient brooms which have little effect upon an inch or so of melted snow. A short time ago a rude snowplow made of boards, weighed down by a tree-trunk, was to be seen in Battersea Park and a few open places. In Paris the heaviest fall of snow is gotten rid of in very short order with the aid of tools, squeegees and revolving brushes which sweep the slush down splendid drains.

Correspondence.

Insects as Food.

To the Editor of the SCIENTIFIC AMERICAN:

The enclosed copy of a letter which I have just received from Mr. Claude Fuller, Government Entomologist of Natal, Pietermaritzburg, Natal, contains comments upon a recent publication from me published in your journal of February 3, 1900, page 71.

Yours most truly,

L. O. HOWARD,

Entomologist, United States Department of Agriculture.

DEPARTMENT OF AGRICULTURE, NATAL,
OFFICE OF THE GOVERNMENT ENTOMOLOGIST.
PIETERMARITZBURG, March 13, 1900.

DEAR MR. HOWARD: I have been much interested by an excerpt from your paper on the "Economic Status of Insects as a Class," which has just caught my eye in the SCIENTIFIC AMERICAN. My old friend Richard Helms also published some notes on "Bugong Moths." He says that "the natives entered the crevices with burning bushes, the heat and smoke from which stifled the moths so that they fell into nets and skins spread upon the ground to catch them. Afterward they were cooked upon a carefully prepared bed of hot ashes and then eaten with great gusto." He adds that the natives foregathered from great distances by the end of each year to participate in this feast and that they throve and waxed very fat. As a school youngster, in N. S. W., I often enjoyed the acid drop exuded by a large bush ant when captured; that said drop originated from the tip of the abdomen made no difference to the relish with which it was absorbed. On arriving here last September I was first struck with the numbers of flying termites around the lamps of the city each night, and then by the number of natives and small white fry gathering them. I have since learned that they are excellent bait for fish and that the natives eat them both cooked and raw. They are toasted in the fire spitted on a pointed stick. I have also made several acquaintances who have tried them fried in a pan with butter. They tell me it is an acquired taste. I can quite believe it, all tropical tastes are acquired. Locusts are eaten by the natives in Basutoland. I am told they make cakes of them—how, I do not know—using only the heads and thorax. Quite recently information was received at this office that the Basutos were eating locusts killed by fungus, accompanied by solicitous inquiries from the Commissioner concerning the possible effects of such a diet.

Most faithfully yours,

CLAUDE FULLER.

Austin Dam.

To the Editor of the SCIENTIFIC AMERICAN:

It is not necessary to suppose that the destruction of the Austin Dam was caused by washing away of the rock at its toe. It failed because it had not width and mass enough.

Before the description of how it failed came here, a prediction was made by me that it had failed by sliding, and this turned out to be correct.

This dam was a submerged weir, having a pressure on its upper side from the hydraulic head due to the difference of level of water above and below it. Added to this was the current running at the rate of seven or eight miles an hour.

To resist this was the weight of the dam. But this must be treated as a submerged body, and the weight of the water displaced be deducted. The resistance to the sliding of rubble masonry is given by Trautwine at 0·47 of the pressure. A short calculation will show that, under the circumstances of 11 feet of water passing over its crest, this dam must have failed. Had it been built a monolith of concrete, and its base carried down 8 or 10 feet into the rock, its chances would have been much better.

THOMAS C. CLARKE,
Mem. Am. Soc., C. E.

New York, April 30, 1900.

[Our correspondent has misread our article on the failure of the Austin Dam, if he understands us to imply that disintegration of the river bed at the toe of the dam was the only, or even the chief, cause of the failure. Resistance to sliding in dams is secured either (1) by building the dam in the form of an arch, convex to the impounded water, and transferring the horizontal thrust to abutments on the banks of the river, or sides of the canyon; (2) by providing sufficient base and mass in a straight dam to resist overturning and to insure that the frictional resistance to displacement between the dam and the river bed shall amply exceed the horizontal thrust; (3) by extending the foundation masonry down into parallel trenches cut in the river bed, and depending upon the sheering strength of the masonry in the trenches to assist the frictional resistance due to the weight.

The last named method was followed in the present case, four trenches appearing in the first design for the dam, although but two were actually built. Of these the one at the toe was the most effective, and if the rock at the toe was cut away by the flood waters, it may well be that the frictional resistance, none too great, as Mr. Clarke points out, at any time, was immediately overcome, and displacement of the whole mass occurred.—ED.]

The Current Supplement.

The current SUPPLEMENT, No. 1271, has a large number of articles of unusual interest. "The Manufacture of the Pneumatic Tire" describes the intricate operations in great detail. "Motor Vehicles for Heavy Traffic" gives sectional views and details of this important means of transporting heavy goods. "Useful Boring and Tapping Machine" describes a most ingenious German machine. "Rails" is a valuable article dealing with the subject in an authoritative manner. "Paints and Varnishes" is by Prof. A. H. Sabin. "Hypnotism in Medicine" is a most interesting article. "The Gold Deposits of Cape Nome" is by Charles G. Yale, statistician of the United States Mint, San Francisco.

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

COMBINED LAND-ROLLER, STALK-CHOPPER AND CLOD-CRUSHER.—JOHN K. GOODMAN, Mount Ulla, N. C. The machine is particularly adapted for cutting corn and cotton stalks and dry weeds, either in rows or broadcast, by passing over them and pressing them down. For breaking clods and rolling land the machine is also useful. In the ends of a drum circular frames are fitted, the drum and frames having coincident radial holes. The drum is also provided with holes intermediate of its ends. A series of detachable knives, each have at the ends shouldered bolts provided with threaded shanks, and at the middle shouldered studs having smooth shanks. The studs are left free so that the knives are held in place; and the studs support the middle portions of the knives, although adapted for instant detachment along with the knives when the bolt-nuts are removed.

APPARATUS FOR OPERATING HAY-STACKERS OR THE LIKE.—JESSE H. STICE, Allerton, Iowa. This invention is concerned chiefly with the provision of simple and effective means for raising the derrick. These means comprise a drum, having a pinion and a ratchet-wheel, and a brake-wheel journaled with respect to the drum. A pawl engages the ratchet-wheel and a brake, the brake-wheel. A sweep is provided, operating a master-wheel meshed with the drum-pinion and provided with a mutilated portion so as to permit the automatic return of the drum under the control of the brake.

CORN-PLANTER.—ISAAC B. ULLOM, Claysville, Penn. By means of this planter corn, pumpkin seed and fertilizer can be discharged from the seed-box simultaneously or independently, or in any desired combination. The seed-box is provided with compartments containing the various kinds of seed, each compartment having an independent outlet. A ready means is provided for throwing the actuating mechanism of the drop-slide out of gear with the slide.

TRANSPLANTER.—PETER S. HOLUM, De Forest, Wis. This machine is devised for transplanting tobacco, cabbage, or other plants, and is constructed in a most simple and durable manner. The transplanter is wheel-supported, and so constructed that the plants to be transported can be placed in position on the machine and held in position until required. The action of the machine is automatic, to the extent that the plants are taken from the carrying device provided for them, and set in the ground and watered without the aid of an attendant. The entire mechanism is under the complete control of the driver.

Mechanical Devices.

AUTOMATIC CANAL-LOCK GATE.—T. T. STODDART, Ottawa, Canada. The inventor states that his invention includes simple mechanism, quick and sure in its movements, operated with a minimum expenditure of power. The power in question is derived from air, water, and gravity. The gate is hollow and oscillates in a horizontal plane on its horizontal edge, on a hollow shaft journaled in the bottom of the side walls and connected with the head water and the lower water. A three-way wicket connects the feed and discharge pipes with the axle of the gate and can be operated to lower the gate into the desired position. A special arrangement is provided for emptying the lower or water gates.

MOTOR-VEHICLE.—EDWIN S. SUTCH, 439 Lemont Street, Roxboro, Philadelphia, Penn. In this motor-vehicle, the means for guiding, for varying the speed, for reversing, and for applying the brakes are all operated by a single handle, so that even a one-armed man can run the carriage. The handle in question, as well as its shaft, has a rectilinearly and longitudinally sliding motion, and also a rotary motion. The shaft is detached from its bearing by the sliding motion. The rotary motion is transmitted to the driving-gears. The shaft also has a horizontally-swinging motion which is transmitted to the steering-gear, and a vertically-swinging motion which is transmitted to the brakes.

PAPER-BOX MACHINE.—JOSEPH T. CRAW, Jersey City, N. J. The object of the invention is to provide a machine which will open the completed blanks even after they have been passed through a printing-press or subjected to great pressure, and by automatically reversing the folding of the box blanks or forms, deliver them in such condition that they can be duly sealed at their ends and set up to receive material.

FIRE-ESCAPE.—CORINNE DUFOUR, Savannah, Ga. The fire-escape comprises a number of balconies, arranged one above the other on the face of a building and provided each with guideways. The guideways extend downwardly and outwardly, so that the uppermost balcony on sliding down its guideway, alights on the next balcony below in step form. Counterbalancing weights are provided for each of the balconies, so that a balcony automatically rises after the person has stepped to the balcony below.

MERRY-GO-ROUND.—WILLIAM JOHNSON, Coney Island, Brooklyn, New York city. The machine is an improvement on such merry-go-rounds which employ crank-arms for seats. The improvements have been so devised that, as the shafts carrying the crank-arms revolve, the crank-arms will descend as regularly as they ascend, thus avoiding the quick return and discomfort usual to this form of machine. The gears and crank-shafts are so constructed that all unnecessary strain will be taken off the track upon which the gearing for the crank-shaft travels.

AUTOMATIC SAFETY-GATE.—WILLIAM T. TAYLOR, Evans, Colo. The invention provides a device intended automatically to open a flood-gate or waste-gate in case the water in a ditch flume, or channel reaches a dangerous level. In front of the gate a perforated bucket is pivoted. The bucket and gate are connected by a chain passing over a wheel, the pivot being located between the ends of the chain. The water as it rises flows into the bucket, thereby drawing on the chain and closing the gate. When the rising of the water ceases, the water flows out through the perforations of the bucket, causing the gate to fall back to its normal position.

Railway-Appliances.

RAIL-CLAMP.—CHARLES W. HILL, Forest City, Ill. The invention is concerned with stopping or blocking devices for steam shovels and excavators mounted on a car-truck and traveling on a railroad for ditching, excavating, and the like. This new and improved rail-clamp is arranged to be carried on a car-truck in order automatically to form a stop for the wheels to prevent backward movement of the truck, and to allow a free forward traveling as the work progresses.

Miscellaneous Inventions

FLANGE-SHIELD.—FREDERICK C. BILLINGS, Macon, Mo. The invention provides a new shield designed for use on the several flanges of a piano-action to prevent the flanges from becoming loose on the rail and to hold the pivot-pins from working out of the flanges, and to hold the flanges themselves in position, even though they be split. The flange-shield can be used under the flange as well as on top. The shield is made in different sizes, according to the size of the flanges to which it is applied.

STORAGE APPARATUS.—ROBERT T. LAMB, Alpika, Miss. The invention is a storage-house with elevating apparatus and revolving chute for quickly and economically storing in suitable bins seed-cotton, cotton-seed, or grain, and also quickly unloading the bins and carrying their contents to the gin-house. The elevating system is independent of that of the gin-house. The motive power is a gasoline-engine, which operates a fan, the seed-cotton being unloaded by suction. When the gin is running two wagons can be unloaded at once.

FOLDING BEDSTEAD.—AIMÉ FRANÇOIS ROUTIER, Boulevard Dienain 4, Paris, France. The bedstead is particularly intended for explorers, but is otherwise serviceable. It is characterized by the supporting cross-pieces connecting the standards or posts at the ends. These cross-pieces afford a comparatively large surface of support and permit the bedstead to be fitted upon any ground, however soft or irregular it may be, without any risk of the bedstead's sinking.

VEHICLE-WHEEL.—JAMES BURNS, Cincinnati, Ohio. This ingenious invention provides a road vehicle-wheel with a flange which can be adjusted to project outward from the rim of the wheel, thus adapting the wheel for use on rails or on roadways. The construction is such as to render the wheel stronger and cheaper than other wheels of its class. The possibility of moving the flange in or out enables the wheel to be used as a vehicle, which can run on rails or on roadways, for which reason the inventor calls his device a "supermotor."

COFFEE-ROASTING APPARATUS.—CHARLES WATSON and ALVER G. LOTZ, Brooklyn, New York. The object of the invention is to provide a heater so constructed as to prevent flame from coming in direct contact with the coffee in the roaster, thus preventing burning. The roaster comprises a cylinder in which the coffee is contained and which communicates with a furnace. Gas and air pipes lead into a combustion-chamber in the lower portion of the furnace; and bars of refractory material are placed radially in the furnace above the combustion-chamber. The heated air is admitted to the furnace, is superheated on its passage through the furnace, and is conducted into the roasting-cylinder at a temperature sufficiently high to roast the material uniformly without burning.

SHAVING-TOOL.—JAMES J. BRYANT, Nailsworth, England. The tool is a leather skiver, or shaver, which is also applicable for scraping or smoothing cross-grained, knotty, and hard wood. The knife is double-edged and reversible, capable of being adjustably guided in its operation so as to insure the making of a true continuous cut. The tool is adapted to work upon a horizontal slab with a degree of efficiency equal to or greater than that of the ordinary inclined beam, so that the inconveniences due to the stooping position over the beam are avoided, and that the working of the tool can be more easily supervised and controlled.

FIRE-ESCAPE.—FREDOUS H. AMES and WILLIAM F. BRYSON, Fort Wayne, Ind. To the outside of the building drums are secured, about which an endless flexible ladder is passed. To the ladder platforms are secured by chains, the platforms serving as supports for the escaping persons. The novel feature of the invention consists in the use of a compressed-air brake to check the speed of the descending platforms.

WIRE-FENCE GATE.—JAMES K. THOMA, Winfield, Kans. The gate has the usual two posts. To one of these posts and to one end of the gate a retractile spring is attached. A keeper in the form of a hook is secured to the other post and designed to be engaged by the gate to hold the spring under tension, whereby the gate is held in closed position.

SUSPENDER-END.—JACOB HEYMAN, Manhattan, New York city. The invention provides an improved suspender end, having its strap reinforced at the inside to withstand the strain exerted by the button-piece on the strap. The strap, its reinforcing-strip, and the drawers-supporting tongue being all made of a single piece of leather, cheapen the cost of manufacture, and also render the suspender-end very durable.

TANK-MOLD.—ORRIN A. DEVER, Cassopolis, Mich. The mold is designed to form cement stock-watering and other tanks. The mold consists of an inner and outer part, each forming a wall, and each having two curved end portions joined by parallel side portions. All of the portions are interchangeable, to permit the making of tanks of various forms.

METALLIC SEAL OR STAMP.—WILLIAM T. REMMEY, Brooklyn, New York city. The seal or stamp has a centrally-located sunken character, a milled background formed by straight and crossing ridges. A plain border surrounds the background and is separated therefrom by an annular groove, extending in depth below the background. The border is in a plane below the background, so that the background will project above the border and will be formed with a uniform milled surface throughout.

MUSIC-BOX ATTACHMENT.—ENNIS C. ROBERTS, Phœnix, Arizona. The invention provides a simple, novel construction, by which a music-box is operated from the wheel of a bicycle. The arrangement is such that the music-box will not play when the bicycle is moved backward.

PERFORATOR.—JAMES F. MCNAMARA, Far Rockaway, Queens, New York city. This device for perforating check-stubs and the like is applied to a printing-press, and is composed of a longitudinally-slotted tympan and a perforating-plate movable in the slot and having an integral spring extension at one end secured to the tympan.

Designs.

BOX-FASTENER.—HOWARD L. MOULE, Richfield, Utah. The fastener is designed for egg-boxes and is constructed with holes whereby it can be screwed in place.

MATCH-BOX.—JAMES J. B. MCELRATH, Centre, Ala. The leading feature of the design consists of a body having a contour approximating that of a shield, surmounted by a partially-open tent, upon which a hand is delineated. The tent has an ornamental canopy, bearing an eye, and at the side of the tent are crossed shepherd's crooks and crossed arrows. Below the tent the shield is decorated with the links of a chain.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated: correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

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Minerals sent for examination should be distinctly marked or labeled.

(7883) R. B. L. asks: 1. Is it proper to say the North Frigid Zone is bounded on the north by the North Pole or should I say it has but one boundary, the Arctic Circle. A. The North Frigid Zone is bounded on the south by the Arctic Circle. It has no other boundary. 2. About what candle power is an ordinary oil lamp which uses a No. 2 wick? A. Prof. Mayer gave the flame of an ordinary kerosene lamp at 6 to 10 candles, according to the angle at which the flame was viewed. 3. About what candle power is an ordinary incandescent gas lamp, the kind which uses a mantel. A. The gas mantel lamps are variable from 20 to 30 candle power.

(7884) W. W. P. asks (1) how sulphuric acid can be prepared from its salts. A. Sulphuric acid is not prepared from salts in a commercial way. It is made by oxidizing sulphurous acid. The somewhat lengthy details of the method can be found in any good chemistry. We can supply you with Remsen's "Chemist y," price $3.50 by mail. 2. How should Leyden jars be connected to obtain the largest spark possible? A. For most experiments Leyden jars are connected in multiple, that is, all the inside coatings are joined by a wire or a chain, and all the outer coatings are made to rest on strips of tin foil in the bottom of the box in which the battery is placed.

(7885) D. D. asks: 1. Has a successful process been yet discovered to smelt copper ore by electricity? If so, can you give me the name of any books which explain the process and where I can get them? A. We are not aware of any commercial use of an electrical process of smelting copper. We can supply you with Borcher's "Electric Smelting and Refining." Price $6 50 by mail. This book is considered a complete treatise on this subject. 2. Is there not an electrical process to remove fatty substances from oils? If so, where can I get particulars? A. We have no description of an electric process for separating fatty substances from oils. It does not seem as if electricity was adapted to this work. These oils are of themselves insulators, and even if a current were sent through them, it would produce electrolysis upon them and so decompose them rather than refine them.

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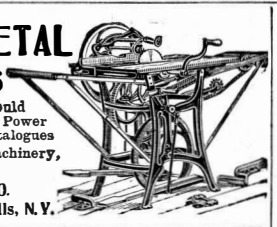

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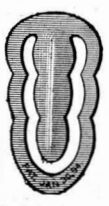

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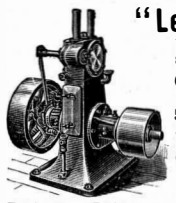

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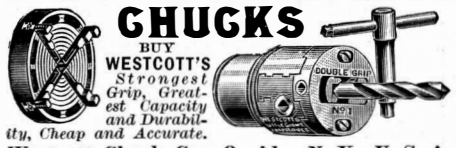

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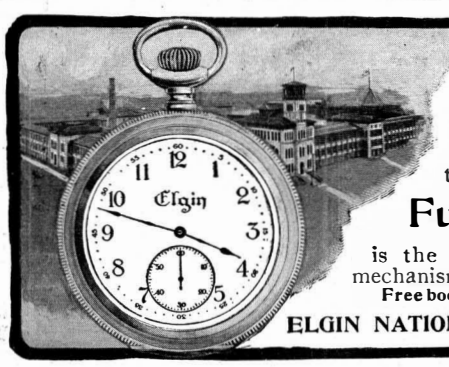

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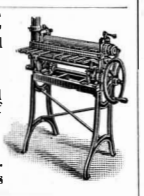

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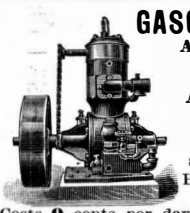

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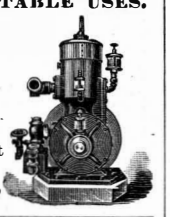

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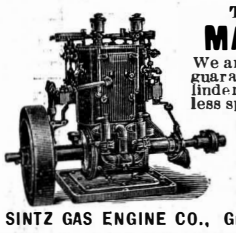

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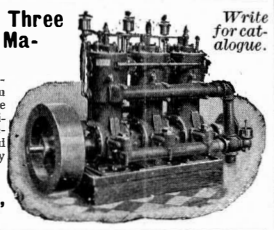

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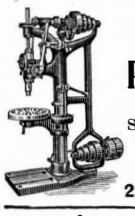

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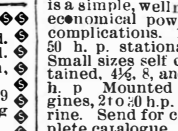

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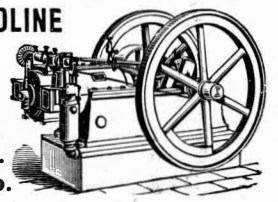

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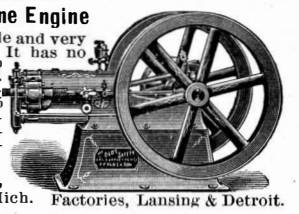

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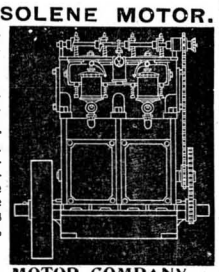

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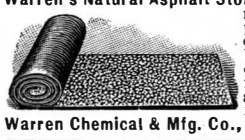

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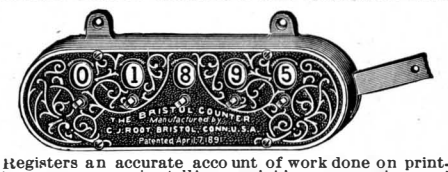

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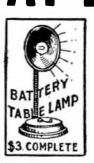

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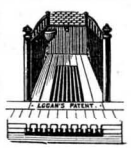

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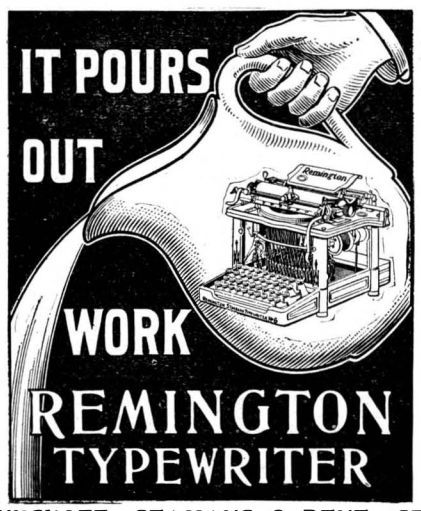

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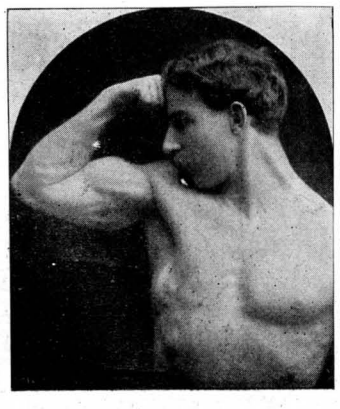

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NEW EAST RIVER BRIDGE,
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NOTICE TO CONTRACTORS.

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Bids will be received by the Commissioners of the New East River Bridge, at their office, at No. 258 Broadway, in the Borough of Manhattan, in the City of New York, at two o'clock in the afternoon of the **31st DAY OF MAY, 1900,** endorsed "BID FOR CONSTRUCTION OF THE STEEL AND MASONRY APPROACH ON THE BROOKLYN SIDE OF THE NEW EAST RIVER BRIDGE," for furnishing the materials for and constructing the steel and masonry approach on the Brooklyn side of the New East River Bridge, in accordance with the proposed form of contract and the drawings and specifications therefor. All bids shall be enclosed in sealed envelopes, addressed to Lewis Nixon, President of the Board of Commissioners of the New East River Bridge, and presented to him on that day and at that hour at said office, and such bids will be opened in public meeting by the said Commissioners on that day at two o'clock in the afternoon.

Copies of the specifications and the general drawings for the work, with the proposed forms for the bid, bond and contract, may be seen, and further information will be given at the office of the Chief Engineer, No. 84 Broadway, Borough of Brooklyn, City of New York, on and after the 28th day of April, 1900.

The Commissioners require that all bidders shall carefully examine the specifications, drawings and proposed form of contract, in order that no question as to their meaning may arise hereafter. It must be distinctly understood that no changes in the quality of the materials or of the workmanship will be allowed, and that the specifications will be adhered to strictly.

The contract is to be completely performed within twelve months after the execution of the contract.

Bids will be made upon a form provided therefor, and only those bids will be considered which are complete, in proper form, comply with the requirements herein stated and are offered by parties of known reputation, experience and responsibility.

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As by far the greater part of this work can be executed only by bridge establishments of the first class, bids will be received only from such parties as have the requisite plant and facilities, which have been in successful operation on work of similar character for at least one year. The bidders must be, in the opinion of the Commissioners, fully qualified both by experience and in appliances to execute work of this character and importance according to the highest standard of such work at the present time.

The Commissioners reserve the right to reject any and all of the bids offered, and to accept any bid offered.

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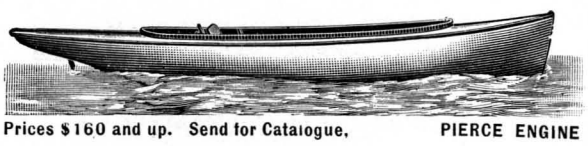

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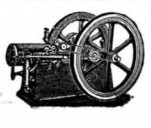

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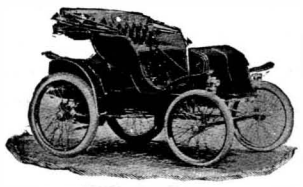

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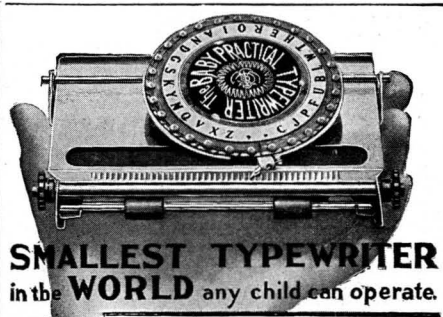

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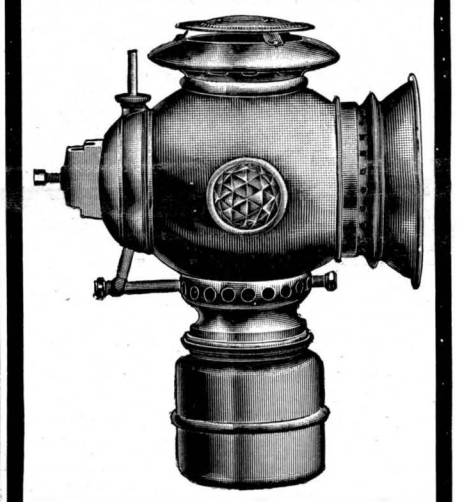

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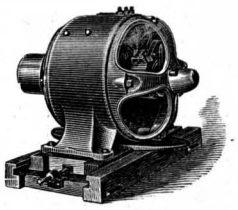

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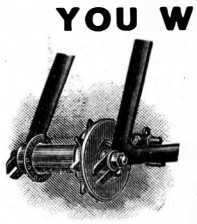

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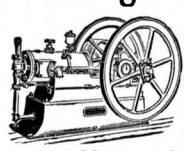

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